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# Soil landscapes of Canada

## PROCEDURES MANUAL AND USER'S HANDBOOK

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## PROCEDURES MANUAL AND USER'S HANDBOOK

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## Preface

Map compilations, involving many people and soil survey agencies, require certain rules and standards to ensure consistency between them. Such is the case of the generalized soil landscape maps compiled by the Land Resource Research Centre (LRRC) of Agriculture Canada. Moreover, if, as is planned, the maps or related attribute data will be updated periodically, the need for consistency and documentation will be even greater. This manual describes the procedures by which land features across Canada are represented on generalized maps and legends; it also defines the attributes that are used.

In 1982 the Generalized Soil Landscape Working Group was established within the Expert Committee on Soil Survey to select differentiating attributes, construct a Phase 1 map legend, and develop the generalization mapping methodology applicable to small-scale mapping. The Prairie Provinces were selected as the pilot study area, and maps of Manitoba, Alberta, and southern Saskatchewan at a scale of 1:1 million were completed by 1984. During the same period, exploratory mapping at 1:1 million scale was also conducted in the Northwest Territories. Three years later, in response to a request by the Eastern Canada Soil Degradation Project, generalized mapping was extended to cover that agricultural region; more recently, coverage was extended westward to include British Columbia and Yukon Territory.

The entire project entailed a number of tasks and objectives including:

- compiling small-scale maps (1:1 million scale) to depict contrasting soil landscape areas
- developing a standardized national legend for all soil landscapes
- describing either one, or at the most two, distinct soil landscapes in each area depicted on the map
- describing them in terms of attributes that are relevant to biological productivity, soil degradation risk, and terrain sensitivity
- designing the necessary procedures, forms, and manuals (of which this is one) needed for the project.

At first the agricultural area of Canada was mapped (Phase 1) and a short set of attributes was compiled in an extended legend. Afterwards, the nonagricultural portion of the following areas was filled in (Phase 2): Prairie Provinces, Island of Newfoundland, British Columbia, Yukon Territory, southern Labrador, and the southwestern part of Quebec. Only northern Ontario, parts of Quebec and Labrador, and the Northwest Territories remain to be compiled.

This manual represents the sixth revision of procedures used during the soil landscapes of Canada project. It documents the most up-to-date extended legend according to Phase 2 standards for mapping and compilation of attributes. It supplements map compilation procedures, attribute descriptors, and the detailed computerized legend referred to in the report that accompanies each soil landscape map.

## Acknowledgments

The dedicated efforts of many persons who willingly contributed to the compilation of this manual are sincerely appreciated including:

- Staff of the LRRC Inventory Section and associated provincial soil survey agencies for their contributions to the project development, for compilation of maps and legend attributes, for inputting, reviewing, and editing the computerized data base.
- Staff of the LRRC Information Systems Unit for the preparation of base maps and for the production of maps and figures.
- Linda Howe and Sandy Roy for their expertise in word processing and their patient cooperation in formatting and typing this manual.

## Introduction

Planning suitable uses for land requires a wide perspective. To assess the potential for cereal production in the prairies, corn production in eastern Canada, or wood production for the whole country, we need consistent and comparable information about the soil and land nationwide. This information is difficult to assemble into an easily manageable product from the large-scale maps and surveys generally available.

Consequently, the Inventory Section of the Land Resource Research Centre (LRRC) undertook to compile a computerized data base to record the attributes of the soil and land for the whole country and to prepare maps from this information at a scale of 1:1 million. The compilation is done by standard methods. The maps are divided into unit areas called polygons. Each polygon is described in terms of a standard set of attributes. These attributes are the factors considered most important for plant growth, general land management, regional planning, terrain sensitivity, and environmental sustainability. The full array of attributes that describe a distinct type of soil and its associated characteristics, such as landform, slope, water table, permafrost, and lakes, is called a soil landscape. A polygon may contain one or two distinctive soil landscapes, as well as small but contrasting inclusions.

The maps themselves and the attributes of every polygon shown on them are stored in the computerized Canada Soil Information System (CanSIS). The information can, therefore, ultimately be made available as paper maps and short reports, and in electronic form.

**Objective** This manual is to document the standard methods and descriptors used by all provinces for compilation of a national soil landscape data base at a scale of 1:1 million, including:

- map compilation from existing source maps or LANDSAT data
- a map legend describing permanent soil and landscape attributes, which can accommodate all major soil mapping systems used across Canada
- a computerized extended legend with defined file structure, attribute list, and class descriptors
- maps in digital form
- products available.

**Product usage** The products can be used for the following purposes:

- to assess the productivity of the land nationally or over large regions
- to find areas that have actual or potential problems affecting land use, such as salinity or susceptibility to erosion, and to assess the severity
- to locate general areas that may be suitable for particular types of land use, which can be selected for more detailed investigations
- to apply general research findings and agrotechnology procedures that are successful in one part of the country to other areas that have similar attributes

- to link soil and land information with other data bases, such as information on climate, economics, or census, for assessing land use on a regional, national, or even an international scale
- to educate students of soil geography at colleges or universities.

## How to use this manual

This manual is designed especially to supplement map compilation procedures, attribute descriptors, and detailed computerized legend data included in the report accompanying each soil landscape map. It documents "General legend concepts and definitions" used in this small-scale mapping project followed by "Map legend development" and "Map compilation" procedures. Users requiring information concerning the map, the map legend, or the accompanying report are referred to the above sections.

Users wishing to use the more detailed computerized extended legend that describes the dominant or subdominant soil landscapes of each map polygon are referred to those three sections. One section provides the attribute list and structure of the computer files for the dominant and subdominant soil landscapes; two other sections provide a detailed description of the attributes and their different classes. As users become more familiar with the data base, they will find it more convenient to refer to the section summarizing soil attribute codes and their classes. The content and definition of digital data for soil landscape maps are described in another section.

Products available from this project are summarized in the last section. These products (Fig. 1) include a map and a printed report containing a tabular extended legend of the 12 major soil landscape attributes occurring in each map polygon. A more detailed computerized legend providing 40 attributes for each polygon is available electronically on diskette in ASCII format.

## General legend concepts and definitions

The framework for the legend development, map compilation, and attribute characterization is established by the following concepts and definitions:

- The maps are comprised of map delineations called polygons, each of which is described in terms of a standard set of attributes.
- The full array of polygon attributes that describe a distinct type of soil and its associated landscape attributes, such as surface form, slope, water table, permafrost, and lakes, is called a soil landscape.
- A polygon may contain one or two distinctive soil landscapes (dominant or subdominant) and may also contain a small but contrasting proportion of inclusions.

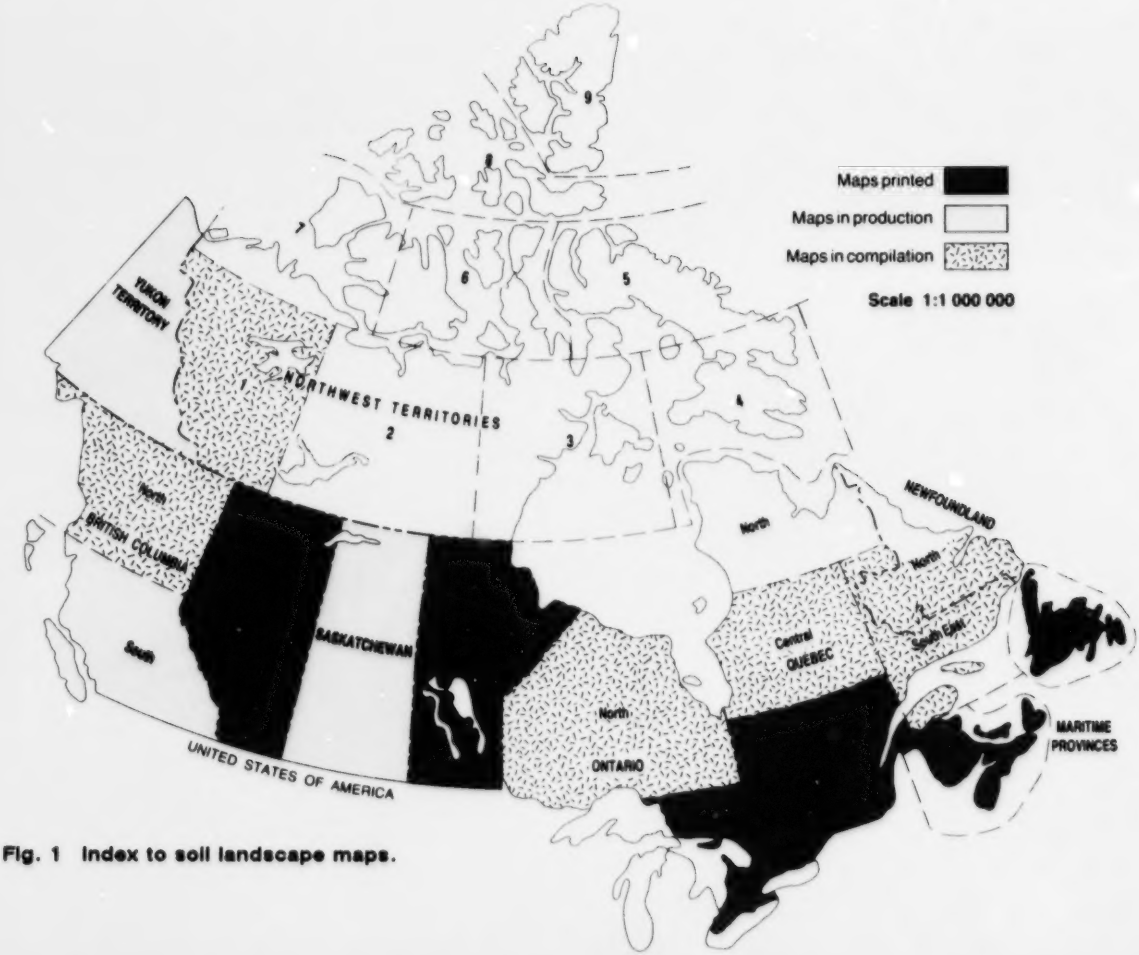



**Fig. 1 Index to soil landscape maps.**

- The dominant (or most prominent) soil landscape represents at least 40% of the polygon area whereas the subdominant soil landscape represents only from 16 to <40% of the polygon; inclusions represent a maximum of 15% of the polygon; a more detailed description of complex map polygons is given in a later section.
- One or two inclusions can be recorded for each dominant and subdominant soil landscape, but in total they represent only a maximum of 15% of the polygon land area.
- Each polygon is assigned a unique identifying number.
- The attributes that separate one polygon from another include (a) soil development, (b) soil parent material mode of deposition, (c) texture class of parent material, (d) local surface form, (e) slope gradient class in percent, (f) kind of rock or surface material except water, and (g) spatial occurrence of these attributes within a polygon; these attributes may apply to either the dominant or subdominant soil landscape.
- The minimum size of the soil landscape area (or polygon) should be about 1 × 1 cm at the 1:1 million scale (100 $km^2$); however, smaller, isolated areas that can be conveniently displayed and labeled on the map are permitted when needed (see "Map compilation").

## Map legend development

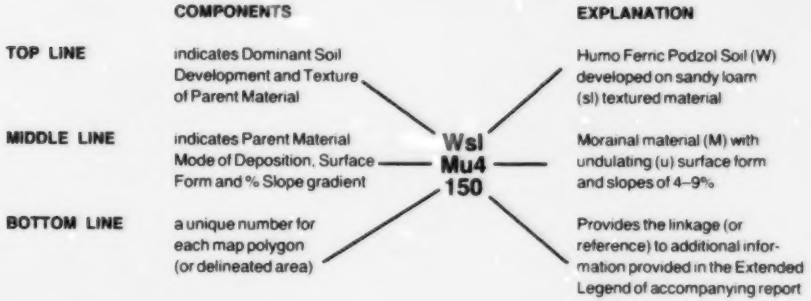
A standardized map legend was developed (Shields 1982) consisting of major attributes important to plant growth and land management, which are used to differentiate one map area (or map polygon) from another, plus additional attributes that are required to make priority interpretations. The sum of these attributes are stored in the computer files of CanSIS as described later.

**Major attributes** The attributes shown in the map symbols (Fig. 2) and legend serve to differentiate one polygon from another. They were chosen for the following reasons:

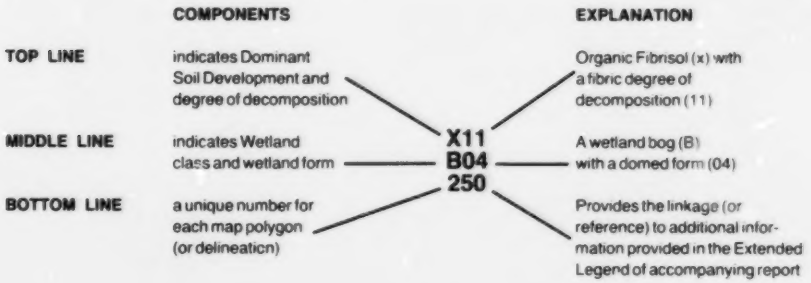
| | |
|---|---|
| soil development | because it indicates likely natural fertility, internal drainage, alkalinity, and reaction (or acidity) |
| texture group of parent material | because it influences the capacity of the parent soil to store moisture and to make moisture available to plants, and, in the case of sandy soils, their susceptibility to wind erosion |
| origin of parent material (mode of deposition) | because it provides information of the surficial geology and a linkage to mapping methods used on the source maps |
| surface form | because it influences soil development, land use, and surface drainage |
| slope class | because it influences land use and water erosion risk, particularly when coupled with long slopes on inclined or rolling surfaces |

# MAP SYMBOL FORMAT

## (a) Format for mineral soils


COMPONENTS
EXPLANATION
TOP LINE
indicates Dominant Soil Development and Texture of Parent Material
Humo Ferric Podzol Soil (W) developed on sandy loam (sl) textured material
MIDDLE LINE
indicates Parent Material Mode of Deposition, Surface Form and % Slope gradient
Morainal material (M) with undulating (u) surface form and slopes of 4–9%
BOTTOM LINE
a unique number for each map polygon (or delineated area)
Provides the linkage (or reference) to additional information provided in the Extended Legend of accompanying report
Wsl
Mu4
150

## (b) Format for organic soils


COMPONENTS
EXPLANATION
TOP LINE
indicates Dominant Soil Development and degree of decomposition
Organic Fibrisol (x) with a fibric degree of decomposition (11)
MIDDLE LINE
indicates Wetland class and wetland form
A wetland bog (B) with a domed form (04)
BOTTOM LINE
a unique number for each map polygon (or delineation)
Provides the linkage (or reference) to additional information provided in the Extended Legend of accompanying report
X11
B04
250

## (c) Format for Rockland

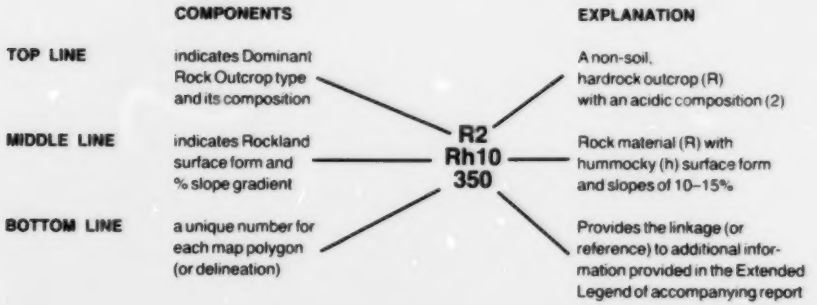

COMPONENTS
EXPLANATION
TOP LINE
indicates Dominant Rock Outcrop type and its composition
A non-soil, hardrock outcrop (R) with an acidic composition (2)
MIDDLE LINE
indicates Rockland surface form and % slope gradient
Rock material (R) with hummocky (h) surface form and slopes of 10–15%
BOTTOM LINE
a unique number for each map polygon (or delineation)
Provides the linkage (or reference) to additional information provided in the Extended Legend of accompanying report
R2
Rh10
350

**Fig. 2 Explanation of map symbols.**

| | |
|---|---|
| kind of rock outcrop (acidic or basic property) | because it influences the chemistry of the drainage water and plant or aquatic growth |
| unique polygon number | because it provides a means of labeling each area |

**Additional attributes** The following attributes are required for more specialized assessments and interpretations. Some of these attributes will be published with the maps and reports. However, they can all be obtained on diskettes in ASCII format with supporting documentation. The detailed computerized legend includes as a minimum, besides the major attributes, the following attributes for dominant and subdominant soil landscapes:

- percentage distribution of soil landscapes
- grid code for locating polygons
- regional landform
- parent material texture
- surface texture of mineral soil to 15 cm
- coarse fragment content in control section
- rooting depth, unrestricted
- kind of compacted, consolidated, or contrasting layer
- depth to compacted, consolidated, or contrasting layer
- drainage
- available water-holding capacity in upper 120 cm
- depth to water table
- dominant type of ice
- ice content
- permafrost occurrence
- depth of active layer in permafrost soils
- kind of patterned ground
- pH of upper 15 cm of soil horizon ($CaCl_2$)
- pH of upper 15 cm of soil horizon (water)
- organic carbon content of upper 15 cm of soil
- nitrogen content of upper 15 cm of soil
- thickness of humus layer
- calcareous class of parent material
- inclusion 1
- inclusion 2
- vegetation cover and/or land use class
- lake size
- water bodies wholly contained in the polygon (percentage coverage)
- reliability class
- complexity class
- soil name 1
- soil name 2
- area of polygon (kilohectares)

The attributes were then arranged and listed in a computerized extended legend file structure applying to the dominant soil landscape occurring within each polygon. The same file structure was also used for attributes

applying to the subdominant soil landscape, when present, in a polygon. This extended legend file makes it possible to systematically compile much more information than that which can be shown on the map symbol or on the map legend, or in the report accompanying the m ɔ. Fig. 3 is an example of the coding form used for compiling the detailed computerized extended legend attributes.

## Map compilation

**Procedures used where source maps exist** It is advised that the following steps be taken when maps are compiled from existing soil maps and legends:

- In compiling generalized small-scale maps, use the most recently available, larger-scaled, soil survey source maps and their reports.
- Establish the size of area at the source map scale that reduces to 1 × 1 cm (100 $km^2$) at a scale of 1:1 million. This area was selected as the smallest mappable area; most areas will be larger. However, a few exceptions exist where generalized map polygons at 1:1 million scale may be smaller than 1 $cm^2$ such as narrow, elongated features and drainage patterns, strongly contrasting soil landscapes, and small islands. Attach map symbols to these smaller polygons by use of a leader, assuming the polygon density adjacent to these areas has room for the extra symbol and leader.
- Overlay and register translucent material with a matte surface (Chronoflex) to the soil survey source map.
- Delineate the major drainage pattern and other major physiographic features on the source map. Avoid making the drainage pattern too detailed, because drainage often bisects soil landscape areas thereby greatly increasing the number of polygons required.
- Delineate large, uniform, soil landscape areas on the source map.
- Translate the source map symbol and legend information to the generalized small-scale map symbol format and assign a unique polygon number. A change in at least one differentiating property class limit on the source map results in a separate generalized polygon.
- Where necessary, group smaller source map polygons that are most similar thereby aggregating areas to form a composite dominant portion of the generalized polygon; compose its map symbol and assign a unique polygon number.
- If necessary, group source map polygons that are dissimilar and proceed as already indicated.
- Continue the same procedure until most areas of the source map are generalized. Review any remaining small areas and decide with which generalized polygons they should most sensibly be combined.
- Review the generalized polygons and their map symbols, and compare them with the source information.

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DOMINANT ATTRIBUTES - DETAILED COMPUTERIZED LEGEND (PHASE 2) - LAST UPDATE 91-06-14

(ATTRIBUTE CLASS CODES ARE DESCRIBED IN SOIL LANDSCAPES OF CANADA PROCEDURES MANUAL AND USERS HANDBOOK)

| P | P | D | D | G | D | D | D

- Code attributes applying to the dominant soil landscape portion of the generalized polygon on the detailed computerized legend (Phase 2) coding form (Fig. 3); repeat for compilation of attributes applying to the subdominant soil landscape portion of the polygon, when present, as listed in the detailed computerized legend.
- Correlate polygon boundaries along adjacent source maps and also along provincial boundaries.
- Reduce the compiled maps on the matte surface overlays photomechanically to 1:1 million scale; process them onto clear material; then mozaic and register them to an appropriate 1:1 million scale base.
- Edit this mozaic carefully to ensure that all boundaries and map symbols are correlated.
- If small islands in the coastal areas are a problem, recognize an island with a minimum size of 0.25 $cm^2$ and code it as a polygon. Where small islands are situated close together in a group, draw a line around them to form a polygon. Estimate the portion of such a polygon that is water and indicate it as a percentage on the coding form.
- Prepare a map positive at a scale of 1:1 million.

**Procedures used where no source maps exist** At present, little or no soil information is available for most northern areas where soil surveys are yet to be carried out. Examples of these areas include Yukon Territory, Northwest Territories, and parts of northern British Columbia, Ontario, Quebec, and Labrador. In many cases there is also a lack of geomorphological data concerning such features as regional landforms, surficial materials, and local surface forms. This lack of information and the inaccessibility of the terrain requires the development of survey methodology, to provide both detailed information on a site-specific basis and general information in the form of small-scale soil landscape maps based on LANDSAT imagery (Tarnocai 1977). This mapping is conducted most efficiently when it is carried out by a pedologist experienced in the northern environment.

The following survey methodology is proposed for areas where no source maps exist:

- Arrange to acquire or have compiled a suitable base map for the project area, at a scale of 1:1 million.
- Compile the map using 1:1 million-scale, cloud-free, high-quality LANDSAT imagery, which is interpreted manually and with the aid of panchromatic photographs.
- Interpret features most readily and consistently observable on LANDSAT imagery including regional landforms, surficial materials, local surface form, occurrence and size of water bodies, wetlands, vegetation, and patterned ground.
- Overlay and register translucent matte surface material (Chronoflex) on the selected LANDSAT image.

- Pretype (or interpret) the imagery in the office by delineating regional landforms and major drainage features to form enclosed map polygons.
- Subdivide these relatively large polygons into smaller polygons dominated by similar surficial material, surface form, patterned ground, slope gradient, wetland type, and water body composition.
- Assign a unique number to each polygon; assignment of a map symbol is optional.
- Make the smallest polygon mapped at least 1 × 1 cm in size; exceptions include small islands or distinct, elongated soil landscape features.
- Complement the interpretation of LANDSAT imagery features with the use of available panchromatic photos to provide or define additional interpretable features and revise polygon boundaries accordingly.
- Correlate polygon boundaries and differentiating attribute features from a completed image to an adjoining image; complete for all images in the project area.
- Review pretyped map and plan the efficient use of fixed-wing (or helicopter) traverses throughout the area; select suitable landing locations from which to conduct ground traverses.
- Conduct planned air traverses to verify the characteristic features and their composition in the pretyped polygons; make corrections where pretyping interpretations do not agree with what is observed from the air.
- Assign decile proportions both to the dominant and subdominant soil landscapes applying to the map polygon, and to the inclusions.
- During ground stops, collect detailed information relating to terrain and vegetation; sample and describe soils; collect as much detailed information as possible at these sampling sites (not merely general information) because these data are often the *only* data available for the soils, terrain, and vegetation of the area.
- Compile attributes applying to the dominant soil landscape portion of the polygon on the detailed computerized legend (Phase 2) coding form (Fig. 3); repeat for compilation of attributes applying to the subdominant soil landscape portion of the polygon, if present.
- Transfer finalized map polygons from Chronoflex overlay on LANDSAT imagery to the base map; label polygons with a unique number (and map symbol if desirable) and submit to Cartographic Section, LRRC, for map production.

**Correlation procedures and quality control** Correlation is the process of maintaining consistency and quality control in compilation of maps of different areas and in compilation of the extended legend attribute classes.

*Map compilers* For the map compiler, correlation requires consistent translation and coding of attributes that apply to the dominant, subdominant, and inclusion portions of the generalized polygon,

particularly in cases where the generalized map polygon comprises two or more source map polygons.

*Provincial project leaders* Provincial project leaders are responsible for correlation activities to resolve differences in map symbols and generalized polygon boundaries on adjacent source maps within a province or between provinces. These discrepancies arise from differences in source map scale, intensity of inspections, and soil classification systems used.

Resolution is achieved by carefully reviewing the information given on the source map legend and report (mapping methodology, kind and scale of aerial photographs, and classification system) so that consistent translation of source information to general polygon attributes is achieved among different map compilers. Attribute files must also be reviewed to eliminate coding placement errors. These types of quality control provide credibility and confidence in the resultant files.

*National project leader* Consistent adherence to nationally established attribute class limits by map compilers in different provinces is the responsibility of the national project leader. This consistency is achieved by preparing procedures manuals, conducting training sessions with provincial project leaders, or compiling maps of selected map areas within a province for use as training areas. Requests for the establishment either of additional attribute classes or of new attributes are also reviewed and appended where necessary.

In cooperation with CanSIS and cartographic personnel, national project leaders ensure that

- data on coding forms are validated and input to the national soil data base archive of CanSIS
- map legends are compiled
- derivative maps are produced
- a national data base management system is developed.

In northern terrain studies it is important that both field work and interpretation be carried out by *people having several years experience* to ensure high-quality and cost-efficient mapping. With this approach, maximum use can be made of both remote sensing and ground verification data, with minimal on-site correlation.

Workshops reviewing mapping methodology, data coding, and correlation procedures for project areas are organized when required.

**Description of complex map polygons** When a polygon was found to contain very different types of soil or important inclusions, the two most prominent soil landscapes (dominant and subdominant) are presented, as well as the inclusions. The proportions of the dominant and subdominant soil landscapes and inclusions in any one polygon (common to all maps and all polygons) are assigned as follows:

| | |
|---|---|
| One soil landscape without or with inclusions | Dominant represents the entire area; for calculations, assume 100% but, if inclusions are present, assume the dominant soil to represent 85% and the inclusions 15% |
| Two soil landscapes | For calculations, assume the dominant soil to represent 70% and the subdominant soil 30% |
| Two soil landscapes and inclusions | For calculations, assume the dominant soil to represent 60%, the subdominant soil 25%, and the inclusions 15%. |

**Explanation of map symbols and colors** There is one map symbol for each polygon. The map legend explains the abbreviations used in the top and middle lines of each map symbol. The top line of the map symbol (Fig. 2), which specifies the soil development and texture grouping of the polygon, determines the color of each map polygon. Each type of soil development is assigned a unique color. Three shades of this color are then used to indicate the various texture groupings of each type of soil development. Lighter shades are used for the grouping of sand and sandy loam textures, intermediate shades are used for the grouping of loams and clay loams, and the darker or most intense shades are used for the clays.

**Updating map information** As new information becomes available (for example, when a soil map for a previously unsurveyed area is produced), the attributes and eventually the soil landscape boundaries will be revised. The revisions will be recorded in the computerized data base stored in CanSIS. New maps will not be regularly published. Therefore, the information in CanSIS will be kept more up-to-date than the published maps. Hard copies of both the maps and the attributes stored in CanSIS can be supplied on request. The detailed computerized legends will also be made available on request.

## Dominant and subdominant soil landscape files: attribute list and structure[1]

| Class no. | Attribute | Type | Width | Dec | Column number | Assigned attribute names |
|---|---|---|---|---|---|---|
| 01 | Provincial code (Cols. 1-2) and map sheet number (Col. 3) | C | 3 | - | 1-3 | PROVINCE |
| 02 | Polygon number | C | 4 | - | 4-7 | POLYNUMB |
| 03 | Kind of rock outcrop or other material at the surface | C | 2 | - | 8-9 | DOMKDMAT |
| 04 | Percentage distribution of soil landscapes | C | 3 | - | 10-12 | DOMDISTR |
| 05 | Grid code for locating polygons | C | 3 | - | 13-15 | GRIDLOCN |
| 06 | Regional landform | C | 1 | - | 16 | DOMREGFM |
| 07 | Local surface form | C | 3 | - | 17-19 | DOMLOCSF |
| 08 | Slope gradient class | C | 1 | - | 20 | DOMSLOPE |
| 09 | Parent material mode of deposition | C | 2 | - | 21-22 | DOMPMDEP |
| 10 | Parent material texture | C | 4 | - | 23-26 | DOMPMTEX |
| 11 | Soil development | C | 1 | - | 27 | DOMDEVEL |
| 12 | Surface texture of mineral soil to 15 cm | C | 4 | - | 28-31 | DOMSRFTX |
| 13 | Coarse fragment content in control section | C | 1 | - | 32 | DOMCFRAG |
| 14 | Rooting depth, unrestricted | C | 3 | - | 33-35 | DOMROOT |
| 15 | Kind of compacted, consolidated, or contrasting layer | C | 1 | - | 36 | DOMCMPLR |
| 16 | Depth to compacted, consolidated, or contrasting layer | C | 1 | - | 37 | DOMCMPDP |
| 17 | Drainage class | C | 1 | - | 38 | DOMDRAIN |
| 18 | Available water capacity in upper 120 cm | C | 1 | - | 39 | DOMAVWAT |
| 19 | Depth to water table, average | C | 1 | - | 40 | DOMWATAB |
| 20 | Ice type | C | 1 | - | 41 | DOMICETY |
| 21 | Ice content | C | 1 | - | 42 | DOMICECT |
| 22 | Permafrost occurrence | C | 1 | - | 43 | DOMPERMA |
| 23 | Active layer depth in soils with permafrost | C | 3 | - | 44-46 | DOMACTLR |
| 24 | Kind of patterned ground in soils with permafrost | C | 2 | - | 47-48 | DOMPATGD |
| 25 | pH of upper 15 cm of soil ($CaCl_2$) | C | 2[2] | - | 49-50 | DOMPHCAL |
| 26 | pH of upper 15 cm of soil (water) | C | 2[2] | - | 51-52 | DOMPHWAT |
| 27 | Organic carbon of upper 15 cm | C | 2[2] | - | 53-54 | DOMORGAN |
| 28 | Nitrogen content of upper 15 cm of soil | C | 1 | - | 55 | DOMNITRO |
| 29 | Thickness of humus layer | C | 1 | - | 56 | DOMHUMLR |
| 30 | Calcareous class of parent material | C | 1 | - | 57 | DOMCALCA |
| 31 | Inclusions 1 | C | 2 | - | 58-59 | DINCLUS1[3] |

(continued)

(concluded)

| Class no. | Attribute | Type | Width | Dec | Column number | Assigned attribute names |
|---|---|---|---|---|---|---|
| 32 | Inclusions 2 | C | 2 | - | 60–61 | DINCLUS2[3] |
| 33 | Vegetative cover and/or landuse | C | 2 | - | 62–63 | DOMVEGET |
| 34 | Lake size from LANDSAT | C | 1 | - | 64 | DOMLAKE |
| 35 | Water bodies from LANDSAT as percentage of polygon | C | 1 | - | 65 | DOMWATBD |
| 36 | Reliability class of polygon | C | 1 | - | 66 | DOMRELIA |
| 37 | Complexity class of polygon | C | 1 | - | 67 | DOMCOMPL |
| 38 | Soil name 1 | C | 6 | - | 68–73 | DOMNAME1 |
| 39 | Soil name 2 | C | 6 | - | 74–79 | DOMNAME2 |
| 40 | Parent material textural group (as shown in map symbol) | C | 2 | - | 80–81 | DOMTEXGP[4] |
| 41 | Area of polygon (kilohectares) | N | 7 | 1 | 82–88 | AREAKHA |

[1] For subdominant attribute names, replace DOM with SUB.
[2] To avoid coding a decimal point, data for pH in $CaCl_2$ and water were each compiled in a two-column field (e.g., 67 means a pH of 6.7).
[3] Subdominant inclusions attribute names are SINCLUS1 and SINCLUS2.
[4] No SUBTEXGP is recorded.

## Dominant and subdominant soil landscape files: attributes, their classes, codes, and descriptors

It is mandatory to compile classes for all dominant and subdominant attributes (01–41) unless they either do not occur or are not applicable, in which case one of the following conventions is used:

- Code a dash (-) to indicate the attribute does not occur as in the case where the subdominant soil landscape is absent.
- Use the character # to indicate the attribute is not applicable to describing the dominant or subdominant soil landscape.

**01 Provincial code** (Cols. 1–2)[1] **and map sheet number** (Col. 3)

Enter the code and the sheet number:

| *Provincial code* | *Map name* | *Sheet number* |
|---|---|---|
| BC | British Columbia—South | 1 |
| | —North | 2 |
| AL | Alberta | 1 |
| SK | Saskatchewan | 1 |

[1] Column numbers here correspond to those given in the attribute list.

| | | |
|---|---|---|
| MN | Manitoba | 1 |
| ON | Ontario—South | 1 |
| | —North | 2 |
| QU | Quebec—Southwest | 1 |
| | —Southeast | 2 |
| | —Central | 3 |
| | —North | 4 |
| NB | New Brunswick[2] | 1 |
| NS | Nova Scotia[2] | 1 |
| PE | Prince Edward Island[2] | 1 |
| NF | Newfoundland—South | 1 |
| | —North | 2 |
| YU | Yukon | 1 |
| NW | Northwest Territories | 1 to 9. |

**02 Polygon number** (Cols. 4–7)

Enter the number.

**03 Kind of rock outcrop or other material at the surface** (Cols. 8–9)

Enter the code:

| *Code* | *Class* | *Description* |
|---|---|---|
| IC | Ice and snow | Ice and snow |
| OR | Organic soil | Contains >30% organic matter by weight |
| R1 | Soft rock, undifferentiated | Rock that can be dug with a shovel, e.g., shales, upper Cretaceous, and Tertiary materials |
| R2 | Hard rock, acidic | Granite |
| R3 | Hard rock, carbonaceous | Limestone |
| R4 | Hard rock, undifferentiated | Hard rock of unspecified origin and properties |
| SO | Mineral soil | Dominantly mineral particles, contains <30% organic matter by weight |
| WA | Water | Water |
| UR | Urban | Urban areas. *Note*: only a few major urban area polygons are shown on maps; do not use for tabulating urban areas. |

[2] For map, see *Soil landscapes of Canada, Maritime Provinces*; for extended legend see *Soil landscapes of Canada: Maritimes*.

**04 Percentage distribution of dominant and subdominant soil landscapes** (Cols. 10–12)

Enter the percentage number. If no source information is available on the distribution, enter general distribution; i.e., 70% for dominant and 30% for subdominant where both occur without inclusions, and 100% where only a dominant soil landscape occurs.

**05 Grid code for locating polygons** (Cols. 13–15)

Enter the code. Each section of the grid covers 1° latitude by 2° longitude on the map area. The grid code consists of a letter (north axis) followed by a number (west axis). The grid codes and the map reliability are shown in the margins of the published map.

**06 Regional landform** (Col. 16)

(*Refs.* Geoanalysis Ltd. 1981; United States Department of Agriculture 1986)

Enter the code. General physical descriptions define classes of regional landforms each represented by a code as follows:

| *Code* | *Class* | *Description* |
|---|---|---|
| B | Tableland (or plateau) dominated | Comparatively flat areas of great extent commonly bounded on at least one side by an abrupt escarpment, or may be terminated by mountains; may be dissected by deep valleys and deeply incised rivers; may be tectonic, erosional, or volcanic in origin; may be step-faulted; slopes generally <10%, in some places 10–15%; relief generally <50 m |
| H | Hilland dominated | Natural elevations rising prominently above the surrounding plain and having a recognizably denser pattern of generally higher knolls or crest lines with an irregular or chaotic surface form composed of upper surface convexity and lower concavity; includes hummocky morainal material, volcanic cones, and conical hills of lava; slopes generally 10–30%; relief generally <100 m |
| M | Mountain dominated | Erosional and volcanic landscapes with relief (vertical distance between higher and lower parts) ≥300 m with |

| | | |
|---|---|---|
| | | most of the area comprising valley to summit terrain; slopes generally >30%. In general the terrain has a restricted summit area and steep sides, irregular shape and considerable bare rock surface, or very thin soil cover; occur as a single, isolated feature or in a group forming a long chain or range; major scarps are relatively steep and straight cliff-like slopes of considerable linear extent separating surfaces such as plateaus lying at different levels |
| O | Organic wetland dominated | Areas dominated by organic material >40 cm thick; contains >30% organic matter by weight; occurs in a variety of wetland surface forms |
| P | Plain dominated | Flat to very gently undulating areas having few or no prominent irregularities; formed by erosional or by depositional (or constructional) processes; include broad, continuous, gently sloping piedmont plains extending along and from the base of a mountain, formed by lateral coalescence of a series of separate but confluent alluvial fans; alluvial processes are mainly responsible for the sedimentation; coarse fragments are rounded by transport over relatively long distances; slopes generally <6%; relief generally <10 m; extent generally >5 km in one direction |
| S | Scarp dominated | An escarpment, cliff, or steep slope of some extent along the margin of a terrace, bench, plateau, hill, or mesa; a scarp may be of any height |
| V | Valley dominated | Terrain dominated by major spillways, drainageways, or mountain trenches separated from surrounding landforms by a *significant and abrupt break in slope*; the valley profile may be V- or U-shaped with an extensive valley floor and flood plain up to about |

| | | |
|---|---|---|
| | | 5 km wide; valley profile may also include eroded terraces and their irregular slope segments. |
| # | Non applicable | (Urban area). |

**07 Local surface form** (Cols. 17–19)

(*Refs.* Agriculture Canada Expert Committee on Soil Survey 1987; National Wetlands Working Group 1987)

Enter the code. Descriptions define classes of local physical surface forms (assemblage of slopes) or recurring pattern of forms occurring at the earth's surface. When applied to consolidated materials, form refers to the product of their modification by geological processes. Select only one code per soil landscape, either from mineral surface forms or from wetland surface forms.

*Mineral surface forms*

| *Code* | *Class* | *Description* |
|---|---|---|
| D | Dissected (Fig. 4) | A dissected (or gullied) pattern providing external drainage for an area |
| H | Hummocky (or irregular) (Fig. 5) | A very complex sequence of slopes extending from somewhat rounded concavities (or swales) of various sizes to irregular, conical knolls (or knobs) and short, discontinuous ridges; there is a general lack of concordance between knolls and swales; slopes are 4–70%; examples: examples: hummocky moraine, hummocky fluvioglacial |
| I | Inclined | A sloping, unidirectional surface with a generally constant slope not broken by marked irregularity or gullies; a weakly developed pattern provides external drainage for the local area; slopes are 2–70%; the form of inclined slopes is not related to the initial mode of origin of the underlying material |
| K | Knoll and kettle (Fig. 6) | A very chaotic sequence of knolls and numerous kettles (or sloughs), which occupy 15–20% of an area and which have no external drainage; slopes are generally >3%; examples: morainal plains and hillands |

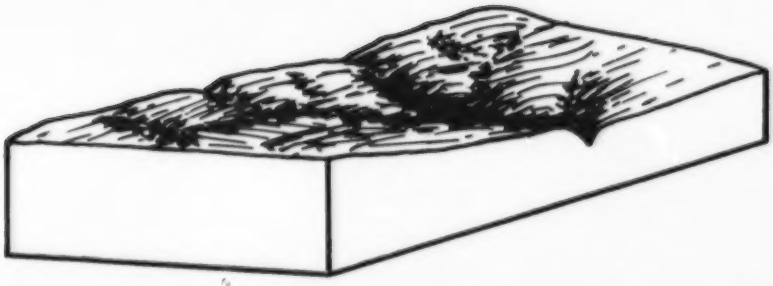

Fig. 4 Dissected surface form.

Fig. 5 Hummocky surface form.

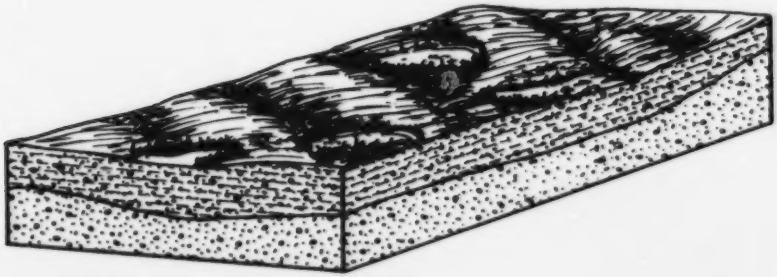

Fig. 6 Knoll-and-kettle surface form.

| | | |
|---|---|---|
| L | Level | A flat or very gently sloping, unidirectional surface with a generally constant slope not broken by marked elevations and depressions; slopes are generally <2% (i.e., 1%); examples: floodplain, lake plain |
| M | Rolling (Fig. 7) | A very regular sequence of moderate slopes extending from rounded and, in some places, confined concave depressions to broad, rounded convexities producing a wavelike pattern of moderate relief; slope gradients are generally >5% but may be less; this surface form is usually controlled by the underlying bedrock |
| R | Ridged (Fig. 8) | A long, narrow elevation of the surface, usually distinctly crested with steep sides; ridges may be parallel, subparallel, or intersecting; examples: eskers, crevasse fillings, washboard moraines, some drumlins |
| S | Steep (Fig. 9) | Erosional slopes >70%, on both consolidated and unconsolidated materials; form of a steep erosional slope on unconsolidated materials is not related to the initial mode of origin of the underlying material; example: escarpments |
| T | Terraced | Scarp face and the horizontal or gently inclined surface (or tread) above it; example: alluvial terrace |
| U | Undulating (Fig. 10) | A very regular sequence of gentle slopes that extends from rounded and, in some places, confined concavities to broad, rounded convexities producing a wavelike pattern of low local relief; slope length is generally <0.8 km and the dominant gradient of slopes is usually 2–5%; it lacks an external drainage pattern; examples: some ground moraine, lacustrine material of varying texture. |

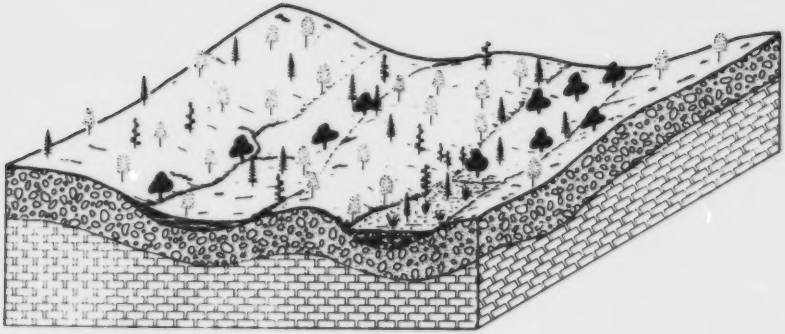

Fig. 7 Rolling surface form.

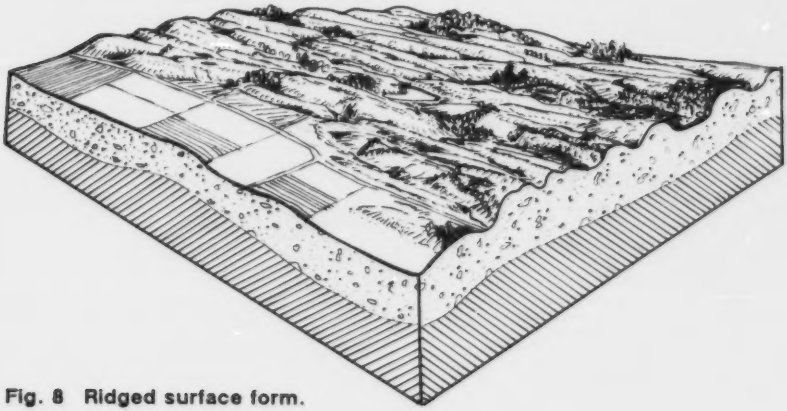

Fig. 8 Ridged surface form.

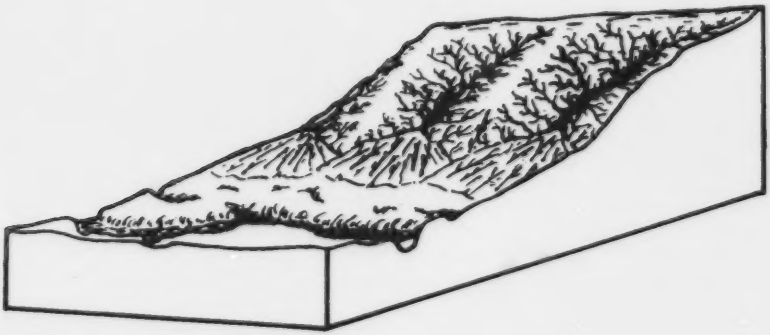

Fig. 9 Steep surface form.

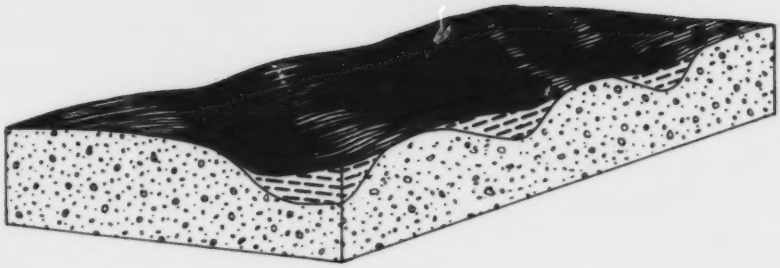

**Fig. 10 Undulating surface form.**

*Wetland surface forms*

| *Code* | *Class* | *Description* |
|---|---|---|
| B04 | Domed bog | A large (diameter usually >500 m) bog with a convex surface, rising several metres above the surrounding terrain; centre usually drains in all directions; small crescentic pools commonly form around the highest point; if the highest point is in the centre, the pools form a concentric or, if the pattern is off-centre, an eccentric pattern; the peat development is usually >3 m |
| B05 | Polygonal peat plateau bog | A perennially frozen bog, rising about 1 m above the surrounding fen; the surface is relatively flat, scored by a polygonal pattern of trenches that developed over ice wedges; the permafrost and ice wedges developed in peat originally deposited in a nonpermafrost environment |
| B07 | Peat plateau bog | A bog composed of perennially frozen peat, rising abruptly about 1 m from the surrounding unfrozen fen; the surface is relatively flat and even, and commonly covers large |

| | | |
|---|---|---|
| | | areas; the peat was originally deposited in a nonpermafrost environment and is associated in many places with collapse scar bogs or fens |
| B09 | Atlantic plateau bog | A bog with a flat-to-undulating surface raised above the surrounding terrain, with the bog edges commonly sloping steeply down towards the mineral soil terrain; large pools scattered on the bog reach a depth of 2–4 m |
| B13 | Basin bog | A bog situated in a basin that has an essentially closed drainage, receiving water from precipitation and from runoff from the immediate surroundings; the surface of the bog is flat, but the peat is generally deepest at the centre |
| B14 | Flat bog | A bog having a flat, featureless surface and occurring in broad, poorly defined depressions; the depth of peat is generally uniform |
| B15 | String bog | A pattern of narrow (2–3 m wide), low (<1 m deep) ridges oriented at right angles to the direction of drainage; wet depressions or pools occur between the ridges; the water and peat are very low in nutrients, as the water has been derived from other ombrotrophic wetlands; peat thickness >1 m |
| B16 | Blanket bog | A bog consisting of extensive peat deposits that occur more or less uniformly over gently sloping hills and valleys; the peat thickness is usually <2 m |
| B18 | Slope bog | A bog occurring in areas of high rainfall on appreciably sloping land surfaces, fed by rainwater and by water draining from other nutrient-poor wetlands; the peat may exceed 1 m in thickness |
| B19 | Veneer bog | A bog occurring on gently sloping terrain underlain by generally discontinuous permafrost; although drainage is predominantly below the surface, overland flow occurs in |

| | | |
|---|---|---|
| | | poorly defined drainageways during peak runoff; peat thickness is usually <1.5 m |
| F01 | Northern ribbed fen | A fen with parallel, low peat ridges ("strings") alternating with wet hollows or shallow pools, oriented across the major slope at right angles to water movement; the depth of peat is >1 m |
| F07 | Shore fen | A fen with an anchored surface mat that forms the shore of a pond or lake; the rooting zone is affected by the water of the lake at both normal and flood levels |
| F11 | Slope fen | A fen occurring mainly on slow-draining, nutrient-enriched seepage slopes; pools are usually absent, but wet seepage tracks may occur; peat thickness usually <2 m |
| F13 | Horizontal fen | A fen with a very gently sloping, featureless surface; this fen occupies broad, often ill-defined depressions and may interconnect with other fens; peat accumulation is generally uniform |
| S01 | Stream swamp | A swamp occurring along the banks of permanent or semipermanent streams; the high-water table is maintained by the level of water in the stream; the swamp is seasonally inundated, with subsequent sediment deposition |
| S04 | Basin swamp | A swamp developed in a topographically defined basin where water derived locally may be augmented by drainage from other parts of the watershed; accumulation of well-decomposed peat is shallow (<0.5 m) at the edge and may reach 2 m at the centre |
| M06 | Stream marsh | A marsh occupying shorelines, bars, streambeds, or islands in continuously flowing water courses; the marsh is subject to prolonged annual flooding and is commonly covered by thick layers of sediments |

| | | |
|---|---|---|
| M11 | Shallow basin marsh | A marsh occurring in a uniformly shallow depression or swale, having a gradual gradient from the edge to the deepest portion; the marsh edge may be poorly defined; water levels fluctuate rapidly |
| M14 | Shore marsh | A marsh occupying the contact zone between high and low water marks bordering semipermanent or permanent lakes; the marsh is usually found along protected shorelines, in lagoons behind barrier beaches, on islands, or in embayments; the marsh is subject to flooding by rise in lake levels, wind, waves, or surface runoff. |
| # | Non applicable | (Urban area). |

**08 Slope gradient class** (Col. 20)

(*Ref.* Shields 1982)

Enter the code:

| *Code* | *Class* |
|---|---|
| A | 1–3% (includes slopes <1%) |
| B | 4–9% |
| C | 10–15% |
| D | 16–30% |
| E | 31–60% |
| F | >60% |
| # | Non applicable (water). |

**09 Soil parent material mode of deposition (or origin)** (Cols. 21–22)

(*Refs.* Tarnocai 1984; Agriculture Canada Expert Committee on Soil Survey 1987; National Wetlands Working Group 1987)

Enter the code. The mode of deposition of mineral materials and undifferentiated organic materials is shown by a single alpha code whereas the origin of specified organic material is given by a numeric, two-digit code.

*Mineral materials and undifferentiated or unspecified organic materials*

| *Code* | *Class* | *Description* |
|---|---|---|
| A | Alluvial | Sediment generally consisting of gravel and sand with a minor fraction of silt and clay; gravels are |

| | | |
|---|---|---|
| | | typically rounded and contain interstitial sand; alluvial sediments are commonly moderately to well sorted and display stratification; examples: channel deposits, overbank deposits, terraces, alluvial fans, and deltas |
| B | Bog | Bogs consist of unspecified organic materials associated with an ombrotrophic environment because the slightly elevated nature of the bog dissociates it from nutrient-rich ground water or surrounding mineral soils; near the surface, materials are usually undecomposed (fibric), yellowish to pale brown, loose and spongy in consistence, and entire sphagnum plants are readily identified; these materials are extremely acid, with low bulk density and high fiber content; at depths they become darker, compacted, and somewhat layered; bogs are associated with slopes or depressions on topography with a water table at or near the surface in the spring and slightly below it during the rest of the year; they are usually covered with sphagnum mosses, but sedges may also grow on them; bogs may be treed or treeless and many are characterized by a layer of ericaceous shrubs |
| C | Colluvial | Massive to moderately well stratified, nonsorted to poorly sorted sediments with any range of particle sizes from clay to boulders that have reached their present position only by direct, gravity-induced movement (excepting snow avalanches); processes include slow displacements such as creep and solifluction and rapid movements such as earth flows |
| D | Residual | Unconsolidated, weathered, or partly weathered soil mineral material that accumulates by disintegration of bedrock in place |

| | | |
|---|---|---|
| E | Eolian | Sediment, generally consisting of medium-to-fine sand and coarse silt particle sizes, that is well sorted, poorly compacted, and may show internal structures such as cross bedding or ripple laminae, or may be massive; individual grains may be rounded and show signs of frosting; these materials have been transported and deposited by wind action; examples: dunes, shallow deposits of sand and coarse silt, and loess but not tuffs |
| F | Fluvioglacial | Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice; deposits are stratified and may occur in the form of outwash plains, deltas, kames, eskers, and kame terraces |
| H | Marsh | Mineral wetland or wetland that is periodically inundated by standing or slow-moving water; surface water levels may fluctuate seasonally, with declining levels exposing drawdown zones of matted vegetation or mudflats; waters are rich in nutrients, varying from fresh to highly saline; substratum usually consists of mineral material, although in some places it consists of well-decomposed peat; soils are predominantly Gleysols, with some Humisols and Mesisols; marshes characteristically show zonal or mosaic surface patterns composed of pools or channels interspersed with clumps of emergent sedges, grasses, rushes, and reeds, bordering grassy meadows and peripheral bands of shrubs or trees; submerged and floating aquatics flourish where open-water areas occur |
| L | Lacustrine | Sediment generally consisting of either stratified fine sand, silt, and clay deposited on the lake bed or moderately well sorted and stratified |

| | | |
|---|---|---|
| | | sand and coarser materials that are beach and other nearshore sediments transported and deposited by wave action; these materials either have settled from suspension in bodies of standing fresh water or have accumulated at their margins through wave action; examples: lake sediments and beaches |
| M | Morainal | Sediment generally consisting of well-compacted material that is nonstratified and contains a heterogeneous mixture of sand, silt, and clay particle sizes and coarse fragments in a mixture that has been transported beneath, beside, on, within, or in front of a glacier and not modified by any intermediate agent; examples: basal till (ground moraine), lateral and terminal moraines, rubbly moraines of cirque glaciers, hummocky ice-disintegration moraines, and preexisting, unconsolidated sediments reworked by a glacier so that their original character is largely or completely destroyed |
| N | Fen | Fens consist of unspecified organic materials formed in a minerotrophic environment because of the close association of the material with mineral-rich waters; it is usually moderately well to well decomposed, dark brown to black, with fine- to medium-sized fibers; decomposition commonly becomes greater at lower depths; the materials are covered with a dominant component of sedges, but grasses and reeds may be associated in local pools |
| O | Organic, undifferentiated | A layered sequence of more than three types of organic material (>30% organic matter by weight) |

| | | |
|---|---|---|
| R | Rock | A consolidated bedrock layer that is too hard to break with the hands (>3 on Mohs' scale) or to dig with a spade when moist |
| S | Swamp | Minerotrophic wetlands with the water table at or above the peat surface; dominant unspecified organic materials are forest and fen peat formed in a eutrophic environment because of strong water movement from the margins or other mineral sources; it is usually moderately well to well decomposed and has a dark brown to reddish brown matrix; the more decomposed materials are black; it has an amorphous or very fine-fibered structure containing a random distribution of woody fragments and trunks of coniferous tree species; the vegetation cover may consist of coniferous or deciduous trees, tall shrubs, herbs, and mosses; in some regions sphagnum mosses are abundant |
| T | Anthropogenic | Materials modified by people, including those associated with mineral exploitation and waste disposal; they include materials deposited as a result of human activities or geological materials modified artificially so that their physical properties (structure, cohesion, compaction) have been drastically altered; examples: areas of landfill, spoil heaps, open-pit mines, leveled irrigated areas |
| U | Undifferentiated | A sequence of more than three types of genetic mineral materials outcropping on a steep erosional escarpment; this complex class is to be used where units relating to individual genetic materials cannot be delimited separately at the scale of mapping; it may include colluvium derived from the various genetic materials and resting upon the scarp slope |

| | | |
|---|---|---|
| V | Volcanic | Volcanic pumice and ash |
| W | Marine | Unconsolidated deposits of clay, silt, sand, or gravel that are well to moderately well sorted and well to moderately well stratified (in some places containing shells); they have settled from suspension in salt or brackish water bodies or have accumulated at their margins through shoreline processes such as wave action and longshore drift; nonfossiliferous deposits may be judged marine, if they are located in an area that might reasonably be considered to have contained salt water at the time the deposits were formed. |

*Specified organic materials*

| *Code* | *Class* | *Description* |
|---|---|---|
| 11 | Fibric sphagnum | Sphagnum organic material in a fibric degree of decomposition in which the fibric materials are readily identifiable as to botanical origin; peat is usually undecomposed (or fibric), light yellowish brown to pale brown, and loose and spongy in consistence with the entire sphagnum plant being readily identifiable |
| 21 | Mesic sedge | Sedge organic material in a mesic (or intermediate) degree of decomposition; peat composed dominantly of sedge (*Carex* spp.) and generally moderately decomposed and matted; the sedge leaves are readily identifiable to the naked eye; this material commonly contains large amounts of very fine roots of the above species |
| 22 | Mesic woody sedge | Woody sedge organic material in a mesic (or intermediate) degree of decomposition; peat is composed dominantly of sedge peat (see code 21) with subdominant amounts of woody materials |

| | | |
|---|---|---|
| 23 | Mesic woody forest | Woody forest organic material in a mesic (or intermediate) degree of decomposition; peat is composed dominantly (>50%) of woody materials derived from both coniferous and deciduous tree species; in general, wood fragments are easily identifiable in this peat |
| 25 | Mesic sphagnum | Sphagnum organic material in a mesic (or intermediate) degree of decomposition |
| 31 | Humic sedge | Sedge organic material in a humic (or most advanced) degree of decomposition in which most of the material is humified, and there are few recognizable fibers |
| # | Non applicable | (Urban area). |

**10 Parent material texture** (Cols. 23–26)

(*Refs.* Research Branch, Agriculture Canada 1976; Expert Committee on Soil Survey 1982)

Soil texture indicates the relative proportions of the various soil separates in a soil as described by the classes of texture shown in Fig. 11.

Soil separates are mineral particles, <2.0 mm in equivalent diameter, ranging between specified size limits:

| *Soil separate* | *Diameter (mm)* |
|---|---|
| Very coarse sand | 2.0–1.0 |
| Coarse sand | 1.0–0.50 |
| Medium sand | 0.50–0.25 |
| Fine sand | 0.25–0.10 |
| Very fine sand | 0.10–0.05 |
| Silt | 0.05–0.002 |
| Clay | <0.002 |

Coarse fragments are rock or mineral fragments >2.0 mm in diameter:

| *Coarse fragment* | *Diameter (cm)* |
|---|---|
| Gravel | 0.2–7.5 |
| Cobble | 7.5–25.0 |

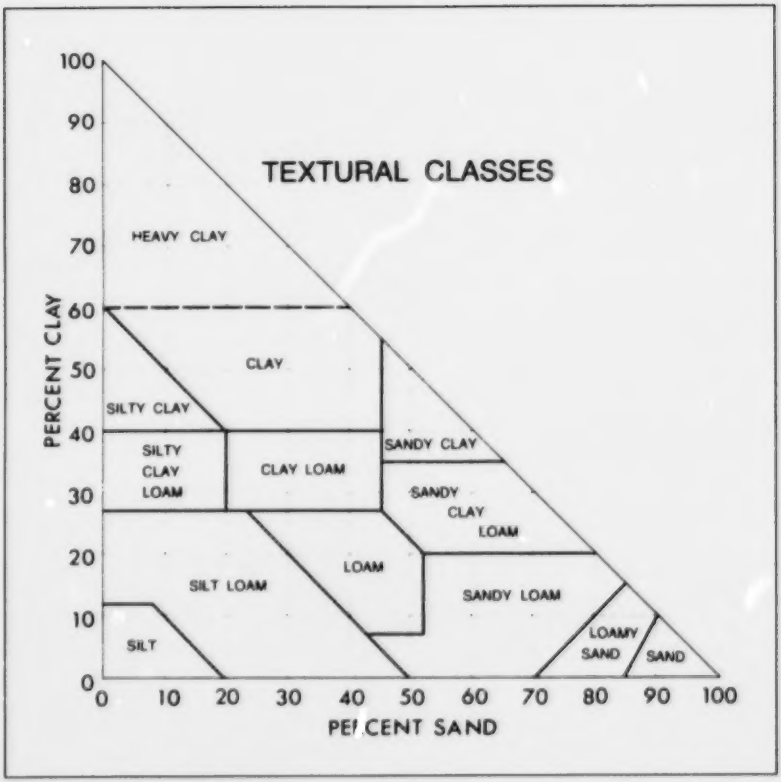


**Fig. 11 Soil textural classes.**

Enter the code for one texture per soil landscape:

| *Code* | *Class* | *Description* |
|---|---|---|
| CBS | Cobbly sand | 15–35% cobbles by volume |
| VGS | Very gravelly sand | 35–60% gravel by volume |
| GS | Gravelly sand | 15–35% gravel by volume |
| S | Sand | See Fig. 11 |
| CS | Coarse sand | 25% or more very coarse and coarse sand |
| FS | Fine sand | 50% or more fine sand |
| VS | Very fine sand | 50% or more very fine sand |
| LFS | Loamy fine sand | 50% or more fine sand |
| LVFS | Loamy very fine sand | 50% or more very fine sand |
| CBLS | Cobbly loamy sand | 15–35% cobbles by volume |
| VGLS | Very gravelly loamy sand | 35–60% gravel by volume |

| | | |
|---|---|---|
| GLS | Gravelly loamy sand | 15–35% gravel by volume |
| LS | Loamy sand | See Fig. 11 |
| CBSL | Cobbly sandy loam | 15–35% cobbles by volume |
| VGSL | Very gravelly sandy loam | 35–60% gravel by volume |
| GSL | Gravelly sandy loam | 15–35% gravel by volume |
| SL | Sandy loam | See Fig. 11 |
| GFL | Gravelly fine sandy loam | 15–35% gravel by volume |
| FL | Fine sandy loam | 30% or more fine sand |
| CBL | Cobbly loam | 15–35% cobbles by volume |
| GL | Gravelly loam | 15–35% gravel by volume |
| L | Loam | See Fig. 11 |
| VL | Very fine sandy loam | 30% or more very fine sand |
| GSIL | Gravelly silt loam | 15–35% gravel by volume |
| SIL | Silt loam | See Fig. 11 |
| GSCL | Gravelly sandy clay loam | 15–35% gravel by volume |
| SCL | Sandy clay loam | See Fig. 11 |
| VCL | Very fine sandy clay loam | 30% or more very fine sand |
| CBCL | Cobbly clay loam | 15–35% cobbles by volume |
| GCL | Gravelly clay loam | 15–35% gravel by volume |
| CL | Clay loam | See Fig. 11 |
| SICL | Silty clay loam | See Fig. 11 |
| SC | Sandy clay | See Fig. 11 |
| C | Clay | See Fig. 11 |
| GSIC | Gravelly silty clay | 15–35% gravel by volume |
| SIC | Silty clay | See Fig. 11 |
| HC | Heavy clay | See Fig. 11 |
| # | Non applicable. | |

**11 Soil development** (Col. 27)

(*Ref.* Agriculture Canada Expert Committee on Soil Survey 1987)

Enter the code:

| *Code* | *Class* | *Description* |
|---|---|---|
| A | Brown Chernozemic | Dominantly Orthic Brown subgroup with inclusions of other subgroups within the Brown great group |
| B | Dark Brown Chernozemic | Dominantly Orthic Dark Brown subgroup with inclusions of other subgroups within the Dark Brown great group |
| C | Black Chernozemic | Dominantly Orthic Black subgroup with inclusions of other subgroups within the Black great group |

| | | |
|---|---|---|
| D | Dark Gray Chernozemic or Dark Gray Luvisolic | Dominantly Orthic Dark Gray Chernozemic subgroup or Dark Gray Luvisol subgroup with inclusions of other subgroups within the Dark Gray great group or of the gleyed Dark Gray Luvisol subgroup |
| E | Gray Brown Luvisolic | Dominantly Orthic Gray Brown Luvisol subgroup with inclusions of other subgroups within the Gray Brown Luvisol great group |
| F | Gray Luvisolic | Dominantly Orthic Gray Luvisol subgroup with inclusions of other Gray Luvisol subgroups |
| G | Brown Solonetzic | May be dominantly Brown Solonetz or Brown Solodized Solonetz or Brown Solod subgroup with inclusions of these subgroups, i.e., dominantly Brown Solodized Solonetz with inclusions of Brown Solod |
| H | Dark Brown Solonetzic | May be dominantly Dark Brown Solonetz or Dark Brown Solodized Solonetz or Dark Brown Solod subgroup with inclusions of these subgroups |
| I | Brunisolic Gray Luvisolic | Dominantly Brunisolic Gray Luvisol subgroup with inclusions of its gleyed subgroup |
| J | Black Solonetzic | May be dominantly Black Solonetz or Black Solodized Solonetz or Black Solod subgroup with inclusions of these subgroups and their gleyed subgroups |
| K | Gray Solonetzic | Dominantly Gray Solodized Solonetz or Gray Solod subgroups with inclusions of their gleyed subgroups |
| L | Melanic Brunisolic | Dominantly Melanic Brunisol great group |
| M | Eutric Brunisolic | Dominantly Eutric Brunisol great group |
| N | Sombric Brunisolic | Dominantly Sombric Brunisol great group |
| O | Organic Cryosolic | Dominantly Organic Cryosol great group |
| P | Dystric Brunisolic | Dominantly Dystric Brunisol great group |
| Q | Humic Podzolic | Dominantly Humic Podzol great group |
| R | Regosolic | Dominantly Regosolic order |

| | | |
|---|---|---|
| S | Static Cryosolic | Dominantly Static Cryosol great group |
| T | Turbic Cryosolic | Dominantly Turbic Cryosol great group |
| U | Gleysolic | Dominantly Gleysolic order |
| V | Ferro-Humic Podzolic | Dominantly Ferro-Humic Podzol great group |
| W | Humo-Ferric Podzolic | Dominantly Humo-Ferric Podzol great group |
| X | Fibrisol | Dominantly Fibrisol great group |
| Y | Mesisol | Dominantly Mesisol great group |
| Z | Humisol | Dominantly Humisol great group |
| 2 | Folisol | Dominantly Folisol great group |
| 3 | Podzolic Gray Luvisolic | Podzolic Gray Luvisol subgroup; only occurs as subdominant |
| # | Non applicable. | (Water, rock, or ice). |

**12 Surface texture of mineral soil to 15 cm** (Cols. 28–31)

(*Refs.* Research Branch, Agriculture Canada 1976; Expert Committee on Soil Survey 1982)

Enter the code for one texture per soil landscape using same codes as for attribute number 10, *Parent material texture*.

**13 Coarse fragment content in control section of mineral soils** (Col. 32)

(*Ref.* Expert Committee on Soil Survey 1982)

Enter the code:

| *Code* | *Class* | *Description* |
|---|---|---|
| A | <10% by volume | Rounded, subrounded, flat, angular or irregular rock fragment from 0.2 to 60 cm or more in size |
| B | 10–30% | |
| C | 31–65% | |
| D | >65% | |
| # | Non applicable. | |

**14 Rooting depth, unrestricted** (Cols. 33–35)

(*Source*: consensus decision, rather subjective)

Enter the code:

| *Code* | *Class* |
|---|---|
| 0 | <20 cm |
| 50 | 20–75 cm |
| 100 | 76–150 cm |
| 200 | >150 cm |
| # | Non applicable (e.g., rock, ice). |

**15 Kind of compacted, consolidated, or contrasting layer** (Col. 36)

(*Refs.* Research Branch, Agriculture Canada 1976; Expert Committee on Soil Survey 1982; United States Department of Agriculture 1986; Agriculture Canada Expert Committee on Soil Survey 1987)

Enter the code:

| *Code* | *Class* | *Description* |
|---|---|---|
| A | Compacted parent material | Compacted glacial till or other material |
| B | Basal till | Compacted glacial till deposited beneath a moving glacier |
| C | Compacted material (anthropogenic) | Soil material compacted by human activities that adversely affect crop production |
| D | Duric horizon | This strongly cemented Bc horizon does not satisfy the criteria of a podzolic B horizon; usually it has an abrupt upper boundary to an overlying podzolic B or to a Bm horizon and a diffuse lower boundary >0.5 m below; cementation is usually strongest near the upper boundary and occurs commonly at a depth of 40–80 cm from the mineral surface; the color of the duric horizon usually differs little from that of the moderately coarse textured to coarse textured parent material, and the structure is usually massive or very coarse platy; air-dry clods of duric horizons do not slake when immersed in water, and moist clods ≥3 cm thick usually cannot be broken in the hands |
| F | Fragipan | Horizon of fragipan character; a fragipan is a loamy subsurface horizon of high bulk density and very low organic matter content; when |

| | | |
|---|---|---|
| | | dry, it has a hard consistence and seems to be cemented; when moist, it has moderate to weak brittleness; it commonly has bleached fracture planes and is overlain by a friable B horizon; air-dry clods of fragic horizons slake in water |
| O | Ortstein | This strongly cemented Bh, Bhf, or Bf horizon, ≥3 cm thick, occurs in more than one-third of the exposed face of the pedon; ortstein horizons are generally reddish brown to very dark reddish brown |
| P | Placic horizon | This layer (commonly ≤5 mm thick) or series of thin layers is irregular or involuted, hard, impervious, commonly vitreous, and dark reddish brown to black; placic horizons may be cemented by Fe, Al-organic complexes (Bhfc or Bfc), hydrated Fe oxides (Bgfc), or a mixture of Fe and Mn oxides |
| R | Rock | Consolidated bedrock too hard either to break with the hands (>3 on Mohs' scale) or to dig when moist |
| G | Gravel | A layer of coarse fragments with diameters of 0.2–7.5 cm |
| L | Colluvium | See attribute number 09, code C |
| S | Sand | Soil texture class in which the material contains >85% of sand-sized separate; the percentage of silt plus 1.5 times the percentage of clay does not exceed 15% |
| X | Silt | Soil texture class in which the material contains ≥80% silt and <12% clay |
| Y | Clay | Soil texture class in which the material contains ≥40% clay, <45% sand, and <40% silt-sized separates. |

**16 Depth to compacted, consolidated, or contrasting layer** (Col. 37)

(*Source*: consensus decision)

Enter the code:

| *Code* | *Class* |
|---|---|
| 1 | 0–49 cm |
| 2 | 50–100 cm |
| 3 | >100 cm |
| 4 | <100 cm for mineral overlays |
| 5 | <160 cm for shallow (terric) organic |
| # | Non applicable. |

**17 Drainage class** (Col. 38)

(*Refs.* Expert Committee on Soil Survey 1982; Agriculture Canada Expert Committee on Soil Survey 1987)

Enter the code:

| *Code* | *Class* | *Description* |
|---|---|---|
| E | Excessive | Water is removed from the soil very rapidly in relation to supply; excess water flows downward very rapidly if underlying material is pervious; subsurface flow may be very rapid during heavy rainfall provided the gradient is steep; source of water is precipitation |
| R | Rapid | Water is removed from the soil rapidly in relation to supply; excess water flows downward if underlying material is pervious; subsurface flow may occur on steep gradients during heavy rainfall; source of water is precipitation |
| W | Well | Water is removed from the soil readily but not rapidly; excess water flows downward readily into underlying pervious material or laterally as subsurface flow; these soils commonly retain optimum amounts of moisture for plant growth after rains or addition of irrigation water |
| M | Moderately well | Water is removed from the soil somewhat slowly in relation to supply; excess water is removed somewhat slowly because of low perviousness, shallow water table, lack of gradient, or some combination of these; precipitation is the dominant source of water in |

| | | |
|---|---|---|
| | | medium-to-fine textured soils; precipitation and significant additions by subsurface flow are necessary in coarse-textured soils |
| I | Imperfect | Water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season; excess water moves slowly downward if precipitation is the major supply; if subsurface water or groundwater, or both, is the main source, the flow rate may vary but the soil remains wet for a significant part of the growing season |
| P | Poor | Water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time the soil is not frozen; excess water is evident in the soil for much of the time; subsurface flow or groundwater flow, or both, in addition to precipitation are the main sources of water; there may also be a perched water table |
| V | Very poor | Water is removed from the soil so slowly that the water table remains at or on the surface for most of the time the soil is not frozen; groundwater flow and subsurface flow are the major sources of water; precipitation is less important except where there is a perched water table |
| # | Non applicable. | |

**18 Available water capacity in upper 120 cm** (Col. 39)

(*Ref.* Research Branch, Agriculture Canada 1976; De Jong et al. 1984)

Enter the code:

| *Code* | *Class* | *Description* |
|---|---|---|
| 1 | 50 mm | That portion of water in a soil that can be readily absorbed by plant roots; most workers consider it to be the water held in the soil between field |
| 2 | 100 mm | |
| 3 | 150 mm | |
| 4 | 200 mm | |

| | | |
|---|---|---|
| 5 | 250 mm | capacity and a pressure of up to about 15 bars |
| 6 | Non applicable | (Solonetzic or saline soils) |
| 7 | Non applicable | (High water table) |
| 8 | Non applicable | (Perennially frozen subsoils) |
| # | Non applicable | (Water, ice, rock). |

**19 Depth to water table, average** (Col. 40)

(*Source*: **concensus decision**)

Enter the code:

| *Code* | *Class* | *Description* |
|---|---|---|
| 1 | 0–2 m | Most shallow water table during growing season |
| 2 | 2–3 m | |
| 3 | >3 m | |
| 4 | 0–1 m | |
| 5 | 1–2 m | |
| 6 | 0–1 m | With perennially frozen subsoil |
| # | Non applicable | (Water, ice, rock). |

**20 Ice type** (Col. 41)

(*Source*: **concensus decision**)

Enter the code:

| *Code* | *Class* |
|---|---|
| 1 | Ice crystals and ice lenses |
| 2 | Ice wedges |
| 3 | Massive ground ice |
| 4 | Undifferentiated |
| # | Non applicable. |

**21 Ice content** (Col. 42)

(*Source*: **concensus decision**)

Enter the code:

| *Code* | *Class* |
|---|---|
| L | Low |
| M | Medium |
| H | High |
| # | Non applicable. |

**22 Permafrost occurrence** (Col. 43)

(*Refs.* Brown 1970, 1978)

Enter the code:

| *Code* | *Class* | *Description* |
|---|---|---|
| V | Very sporadic | Sparse patches of permafrost occurring near the southern limit of permafrost |
| S | Sporadic | The occurrence of isolated patches or islands of permafrost near the southern boundary of discontinuous permafrost zone |
| D | Discontinuous | Permafrost occurring in some areas beneath the exposed land surface throughout a geographic region where other areas are free of permafrost |
| C | Continuous | Permafrost occurring everywhere beneath the exposed land surface throughout a geographic region with the exception of widely scattered sites, such as newly deposited unconsolidated sediments |
| # | Non applicable. | |

**23 Active layer depth in soils with permafrost** (Cols. 44–46)

(*Ref.* Permafrost Subcommittee, Associate Committee on Geotechnical Research 1988)

Enter the number representing depth in centimetres:

| *Entry* | *Class* | *Description* |
|---|---|---|
| Depth in cm | Average depth of active layer (cm) | Top layer of ground subject to annual thawing and freezing in areas underlain by permafrost |
| # | Non applicable. | |

**24 Kind of patterned ground in soils with permafrost** (Cols. 47–48)

(*Refs.* Washburn 1980; National Wetlands Working Group 1987; Permafrost Subcommittee, Associate Committee on Geotechnical Research 1988)

Enter the code:

| Code | Class | Description |
|---|---|---|
| 01 | Sorted circle | Patterned ground having a dominantly circular mesh and a sorted appearance commonly produced by a border of stones surrounding finer material |
| 02 | Sorted net | Patterned ground having a mesh neither dominantly circular nor polygonal; a sorted appearance results from borders of stones surrounding finer material |
| 03 | Sorted stripe | Patterned ground with a striped pattern and sorted appearance resulting from parallel lines of stones and intervening stripes of finer material oriented down the steepest available slope |
| 04 | Sorted large polygon | Patterned ground having a dominantly polygonal mesh and a sorted appearance commonly produced by border of stones surrounding finer material; polygon diameter is >1 m |
| 05 | Sorted small polygon | As for code 04 except that polygon diameter is <1 m |
| 06 | Nonsorted circle | Patterned ground having a dominantly circular mesh but lacking a border of stones |
| 07 | Nonsorted net | Patterned ground having neither a dominantly circular or polygonal mesh nor a border of stones |
| 08 | Nonsorted large polygon | Patterned ground having a dominantly polygonal mesh but lacking a border of stones; polygon diameter is >1 m |
| 09 | Nonsorted small polygon | As for code 08 except that polygon diameter is <1 m |
| 10 | Earth hummock | Hummock having a core of silty and clayey mineral soil and showing signs of cryoturbation |
| 11 | Lowland (peat) polygon | Bog with flat-topped or convex peat surfaces separated by trenches over ice wedges that form a polygonal pattern at the surface |
| 12 | Polygonal peat plateau | Generally flat-topped expanse of peat elevated above the general surface of a wetland and containing segregated |

| | | |
|---|---|---|
| | | ice that may or may not extend downward into underlying mineral soil |
| 13 | No pattern | Unpatterned ground |
| # | Non applicable. | |

**25 pH of upper 15 cm of soil measured in $CaCl_2$** (Cols. 49–50)

(*Ref.* Research Branch, Agriculture Canada 1976)

Enter pH value to one decimal in the two designated columns (e.g., a pH value of 6.7 is coded as 67).

\# Non applicable (water, rock, ice).

**26 pH of upper 15 cm of soil measured in water** (Cols. 51–52)

(*Ref.* Research Branch, Agriculture Canada 1976)

Enter pH value to one decimal in the two designated columns (e.g., a pH value of 6.7 is coded as 67).

\# Non applicable (water, rock, ice).

**27 Organic carbon of upper 15 cm of soil** (Cols. 53–54)

(*Ref.* Research Branch, Agriculture Canada 1976)

Enter nearest % value of organic carbon.

\# Non applicable (water, rock, ice).

**28 Nitrogen content of upper 15 cm of soil** (Col. 55)

(*Source*: concensus decision)

Enter the code:

| *Code* | *Class* |
|---|---|
| 0 | <0.1% |
| 1 | 0.1–0.5% |
| 2 | 0.6–1.5% |
| 3 | >1.5% |
| # | Non applicable (water, rock, ice). |

**29 Thickness of humus layer** (L,F,H) (Col. 56)

(*Source*: concensus decision)

Enter the code:

| *Code* | *Class* |
|---|---|
| 0 | <5 cm |
| 1 | 5–10 cm |
| 2 | 11–20 cm |
| 3 | 21–40 cm |
| 4 | >40 cm |
| # | Non applicable (e.g., cultivated, eroded). |

**30 Calcareous class of parent material** (Col. 57)

(*Ref.* Agriculture Canada Expert Committee on Soil Survey 1987)

Enter the code:

| *Code* | *Class* | *Description* |
|---|---|---|
| 0 | Non calcareous | No $CaCO_3$ detectable with dilute HCl |
| 1 | Weakly | 1–5% $CaCO_3$ equivalents (weak effervesence with dilute HCl) |
| 2 | Strongly | 6–40% $CaCO_3$ equivalents (moderate to strong effervescence with dilute HCl) |
| 3 | Extremely | >40% $CaCO_3$ equivalents (very strong effervescence with dilute HCl) |
| # | Non applicable | (Water, rock, ice). |

**31 Inclusions 1** (Cols. 58–59)

(*Refs.* Research Branch, Agriculture Canada 1976; Expert Committee on Soil Survey 1982; Agriculture Canada Expert Committee on Soil Survey 1987)

NOTE: Inclusions may represent a maximum of 15% of the polygon area. Although their percent occupance is relatively small, they are generally strongly contrasting to the dominant or subdominant soil landscapes. A maximum of two inclusions may be recorded for each of the dominant and subdominant soil landscapes; a maximum of four inclusions may be recorded for each polygon. Inclusions provide an opportunity to document that "little bit" of extra information about the polygon. They may be associated with the dominant or subdominant soil landscape or they may occur independently. Extreme caution is recommended when using inclusion information in area calculations.

Enter the code:

| *Code* | *Class* | *Description* |
|---|---|---|
| A | Acid surface soil | pH <6.0 |
| BG | Bog | See attribute number 09, code B |
| BL | Black Chernozemic soil | See attribute number 11, code C |
| BC | Brown Chernozemic soil | See attribute number 11, code A |

| | | |
|---|---|---|
| BR | Bedrock, hard | Consolidated bedrock that is too hard either to break with the hands (>3 on Mohs' scale) or to dig with a spade when moist |
| BS | Bedrock, soft | Bedrock that can be broken with the hands (<3 on Mohs' scale) and dug with a spade when moist |
| C | Clay substrate | Clay material forming a lithologic discontinuity within 1 m of the soil surface |
| CA | Calcareous surface soil | Indicated by visible effervescence when dilute HCl is added |
| CC | Colluvium | See attribute number 09, code C |
| CH | Chernozemic soil | Unspecified Chernozemic soils; more than one subgroup present |
| CY | Clay | See attribute number 10 |
| D | Dissected surface form | See attribute number 07, code D |
| DB | Dark Brown Chernozemic soil | See attribute number 11, code B |
| DC | Deep colluvium | Colluvial material (see attribute number 09, code C) to a depth of >1 m |
| DG | Deep gravelly fluvioglacial material | Gravelly fluvioglacial material to a depth of >1 m; see attribute numbers 09 (code F) and 10 |
| DU | Duric material | See attribute number 15, code D |
| E | Eroded knolls | Relatively light-colored knolls compared to other slope positions, occurring in hummocky or knoll-and-kettle surface forms |
| EO | Eolian material | >50 cm of eolian material (see attribute number 09, code E) |
| ES | Eroded slopes | Slopes eroded by water |
| F | Fluvioglacial substrate | Substrate of fluvioglacial material (see attribute number 09, code F) |
| FH | Ferro-Humic Podzolic soil | See attribute number 11, code V |
| FO | Folisol | See attribute number 11, code 2 |
| G | Sandy loam morainal material | Morainal material with a sandy loam texture (see attribute number 10) |
| GF | Gravelly alluvium | See attribute numbers 09 (code A) and 10 |
| GG | Gravelly fluvioglacial material | See attribute numbers 09 (code F) and 10 |
| GL | Gleyed soil | Presence of faint to distinct mottles |

| | | |
|---|---|---|
| | | (or blotches) of different color interspersed within the dominant matrix color |
| GM | Gravelly marine material | See attribute numbers 09 (code W) and 10 |
| GV | Orthic Gray Luvisolic soil | See attribute number 11, code F |
| GY | Gleysolic soil | See attribute number 11, code U |
| HC | Shallow lithic colluvium | Colluvial material (see attribute number 09, code C) overlying a lithic contact 50–100 cm from the surface |
| HP | Humo-Ferric Podzolic soil | See attribute number 11, code W |
| HU | Hummocky surface form | See attribute number 07, code H |
| I | Brunisolic Gray Luvisolic soil | See attribute number 11, code I |
| IC | Ice | See attribute number 03, code IC |
| ID | Imperfectly drained soil | See attribute number 17, code I |
| L | Melanic Brunisolic soil | See attribute number 11, code L |
| LC | Lacustrine material | See attribute number 09, code L |
| LF | Loamy alluvium material | See attribute numbers 09 (code A) and 10 |
| LI | Lithic layer | Bedrock occurring within the normal depth of soil development, usually within 1 m of the soil surface |
| LM | Loamy morainal till | Till (or morainal) material in which soil separates contain <35% clay and coarse fragments occupy <35% by volume |
| LO | Loamy marine material | See attribute numbers 09 (code W) and 10 |
| LS | Silty lacustrine material | See attribute numbers 09 (code L) and 10 |
| LU | Luvisolic soil | See attribute number 11, code E or F |
| M | Eutric Brunisolic soil | See attribute number 11, code M |
| ML | Clay loam marine material | See attribute numbers 09 (code W) and 10 |
| MP | Moss peat | Relatively undecomposed, spongy organic material |
| N | Sombric Brunisolic soil | See attribute number 11, code N |
| NN | None | |
| O | Organic material | See attribute number 09, code O |

| | | |
|---|---|---|
| OC | Organic Cryosolic soil | See attribute number 11, code O |
| OT | Ortstein | See attribute number 15, code O |
| P | Dystric Brunisolic soil | See attribute number 11, code P |
| PD | Poorly drained soil | See attribute number 17, code P |
| PP | Poorly drained, peaty soil | Poorly drained soil with a peaty surface layer (<40 cm thick) |
| R1 | Soft rock outcrops | See attribute number 03, code R1 |
| R2 | Hard rock outcrops, acidic | Granite rock outcrops |
| R3 | Hard rock outcrops, basic | Limestone rock outcrops |
| R4 | Hard rock outcrops, undifferentiated | See attribute number 03, code R4 |
| RD | Rapidly drained soil | See attribute number 17, code R |
| RG | Regosolic soil | See attribute number 11, code R |
| SA | Saline soil | Soil causing an obvious reduction in crop growth, may have white surface crust |
| SC | Static Cryosolic soil | See attribute number 11, code S |
| SD | Sandy marine material | Marine material with a sand texture class; see attribute numbers 09 (code W) and 10 |
| SF | Sandy alluvium | See attribute numbers 09 (code A) and 10 |
| SG | Sandy fluvioglacial material | Fluvioglacial material but with a sand texture class; see attribute numbers 09 (code F) and 10 |
| SH | Gravelly shoreline | See attribute number 10 |
| SL | Silty alluvium | See attribute numbers 09 (code A) and 10 |
| SO | Sombric Humo-Ferric Podzolic soil | See attribute number 11, code W |
| SP | Steep surface form | See attribute number 07, code S |
| SS | Silty surface texture | See attribute number 10 |
| ST | Stoney surface | Sufficient stones to seriously handicap cultivation |
| SY | Sandy material | See attribute number 10 |
| T | Till substrate | Till (or morainal) material forming a lithologic discontinuity within 1 m of the soil surface |
| TA | Talus | Sloping mass of rock fragments below a cliff or at the foot of a steep slope |
| TC | Turbic Cryosolic soil | See attribute number 11, code T |

| | | |
|---|---|---|
| TE | Terric layer | Unconsolidated mineral substratum occurring within the normal depth of organic soil development (40–160 cm) |
| TR | Terraced surface form | See attribute number 07, code T |
| TT | Anthropogenic material | See attribute number 09, code T |
| VA | Volcanic ash | Deposition of fine, wind-transported material of volcanic origin deposited in thin layers that persist for a long time in bogs, river terraces, talus slopes, and kettle holes |
| VS | Very shallow lithic layer | Rock material occurring at <50 cm from the surface |
| WD | Well-drained soil | See attribute number 17, code W |
| WE | Wind erosion | Removal of surface soil particles caused by wind action |
| WT | Wetlands | Lands dominated by the persistent presence of excess water indicated by Gleysolic and shallow Organic soils under a cover of hydrophytic vegetation |
| X | Fibrisol | See attribute number 11, code X |
| Y | Mesisol | See attribute number 11, code Y |
| Z | Humisol | See attribute number 11, code Z |
| 11 | Fibric-sphagnum soil | Sphagnum organic soil in the stage of decomposition in which fibric materials are readily identifiable as to botanical origin |
| 14 | Patterned ground | See attribute number 24 |
| 17 | Bouldery material | Rounded or irregular coarse fragments >60 cm in diameter |
| 21 | Mesic-sedge material | Sedge organic material in a mesic (or intermediate) degree of decomposition |
| 23 | Mesic-woody forest material | Woody-forest organic material in a mesic degree of decomposition; the material is partly altered physically and biochemically |
| # | Non applicable. | |

**32 Inclusions 2** (Cols. 60–61)

(See attribute number 31 for codes, classes, and descriptions)

**33 Vegetative cover or landuse, or both** (Cols. 62–63)

(*Refs.* National Wetlands Working Group 1987; Permafrost Subcommittee, Associate Committee on Geotechnical Research 1988)

Enter the code:

| *Code* | *Class* | *Description* |
|---|---|---|
| A | Agricultural crops | Annual field crops |
| B | Bog | Bogs may be treed or treeless and are usually covered with *Sphagnum* spp. and ericaceous shrubs |
| C | Coniferous forest | Dominated by needle-leaved, cone-bearing species |
| D | Deciduous forest | Dominated by broadleaf species |
| F | Fen | Dominated by sedges, grasses, reeds, and brown mosses with some shrubs and, at times, a sparse tree layer |
| G | Grassland | Perennial native grassland or improved pasture |
| H | Arctic desert | Unvegetated areas in the polar desert of the high Arctic; may be caused by either climatic (too cold or too dry) or edaphic (low soil nutrients or toxic substrate) factors, or a combination of both |
| M | Mixed deciduous and coniferous forest | See codes C and D |
| P | Parkland | A forest–grassland transition comprising a mozaic of trembling aspen stands interspersed with patches of cropland, grassland, and meadow |
| R | Marshland | A mozaic surface pattern composed of pools or channels interspersed with clumps of emergent sedges, grasses, rushes, and reeds, bordering grassy meadows and peripheral bands of shrubs or trees; submerged and floating aquatics flourish in open water areas |
| S | Shrubland | Dominated by shrub species |
| SP | Sedge peat | Dominated by *Carex* spp. and generally moderately decomposed and matted; the sedge leaves are readily identifiable to the naked eye |
| TA | Tundra, alpine | Treeless terrain found at high altitudes occurring immediately above the forest zone and the upper altitudinal timberline; tundra vegetation comprises lichens, |

| | | |
|---|---|---|
| | | mosses, sedges, grasses, forbs, and low shrubs (≤20 cm) including heaths, dwarf willows, and birches |
| TL | Tundra, low shrub | Treeless terrain found at high latitudes occurring most widely in the zone immediately north of the boreal forest including the treeless parts of the forest-tundra ecotone adjacent to the treeline; tundra vegetation comprises lichens, mosses, sedges, grasses, forbs and low shrubs (≤20 cm) including heaths, dwarf willows, and birches |
| TM | Tundra, medium shrub | Similar to low-shrub tundra (see code TL) except for medium (>20 cm) instead of low shrubs |
| U | Unvegetated surface | |
| # | Non applicable. | |

**34 Lake size estimated from LANDSAT imagery** (Col. 64)

(*Source*: concensus decision)

Enter the code:

| *Code* | *Class* | *Description* |
|---|---|---|
| S | Small | <1 $km^2$ (not visible on 1:1 million scale LANDSAT imagery) |
| M | Medium | 1–10 $km^2$ |
| L | Large | 11–50 $km^2$ |
| V | Very large | >50 $km^2$ |
| # | Non applicable. | |

**35 Water bodies estimated from LANDSAT imagery, which are wholly contained within the polygon, in percentage coverage of entire polygon** (Col. 65)

(*Source*: concensus decision)

Enter the code:

| *Code* | *Class* | *Description* |
|---|---|---|
| F | Few | Water-bodies cover 0–10% area of polygon |
| C | Common | Water-bodies cover 11–25% area of polygon |
| M | Many | Water-bodies cover 26–50% area of polygon |

| | | |
|---|---|---|
| A | Abundant | Water-bodies cover >50% area of polygon |
| # | Non applicable. | |

**NOTE: Lakes and water bodies whose shorelines form polygon boundaries are not included.**

**36 Reliability class of polygon** (Col. 66)

(*Source*: consensus decision)

Reliability of generalized maps is required to provide an indication of the confidence that can be placed in derivative interpretations and to assist in assigning priorities for future field-mapping projects. Four levels of map reliability have been established in relation to inspection intensity and publication scale of source documents and whether aerial photographs are used during field mapping.

Enter the code:

| *Code* | *Class* | *Description* |
|---|---|---|
| V | Very low | Compiled from interpretation of LANDSAT data *only*; no ground data are collected for verification of these areas |
| L | Low | Compiled from soil survey maps produced from field traverses at wide intervals (up to 10 km) and without the use of aerial photographs<br>*or*<br>Compiled from maps produced by inspections using fixed-wing aircraft or helicopter and aided by interpretation of LANDSAT imagery |
| M | Medium | Produced from systematic traverses by helicopter and by interpretation of stereoscopic aerial photographs<br>*or*<br>Compiled from modern soil survey procedures, which include traversing existing accessible roads in wilderness areas, and aided by interpretation of stereoscopic aerial photographs |
| H | High | Compiled from modern soil survey maps produced from field traverses at ≤1.6-km intervals and with the aid of stereoscopic aerial photographs. |

**37 Complexity class of polygon** (Col. 67)

(*Source*: **consensus decision**)

Complexity of soil landscape attribute classes is determined from information provided on source maps and the accompanying soil reports. The concept of complexity provides an indication of attribute variability within a polygon, particularly with respect to the classes of parent material deposition modes and soil development. Three levels of complexity have been established. They provide a warning of variability to anyone interpreting the information.

Enter the code:

| *Code* | *Class* | *Description* |
|---|---|---|
| L | Low | Soil and landscape attributes within the polygon are uniform for most interpretations; in most cases the polygon has only a dominant component |
| M | Medium | Soil and landscape attributes are moderately variable but predictable; there are generally dominant and subdominant components, each of which usually have been generalized from no more than two classes of parent material or soil development, or both; there may also be an inclusion in the polygon |
| H | High | Soil and landscape attributes are highly variable and unpredictable; dominant, subdominant, and inclusion components are present, each of which has been generalized from more than two classes of parent material or soil development, or both; use this class to warn of extreme oversimplification in any interpretations from the extended legend. |

**38 Soil name 1** (Cols. 68–73)

(*Source*: **consensus decision**)

Provision has been made for a maximum of two soil name codes each for the dominant and subdominant soils. Soil name 1 is considered to be most representative of each soil landscape. Soil name 2 may be used to signify a codominant combination of two soils or an important, closely associated soil in the landscape.

Caution is recommended when using soil name 2 in area calculations particularly for subdominant landscapes.

Soil name codes (and modifiers when present) are included in this detailed legend to provide a link to the national CanSIS soil names and soil layer files. Data in the soil layer file is required for agricultural and nonagricultural use interpretations, simulation modeling, and general land evaluation studies.

Enter the soil name code (and modifier when present) as found in the soil names file maintained at the local soil survey office. This code indicates the most representative soil in the dominant or subdominant soil landscape. The soil name code and modifier are consistent with those documented in the national CanSIS soil name and soil layer files. For areas where no soil name is established, use # for non applicable.

**39 Soil name 2** (Cols. 74–79)

(*Source*: consensus decision)

Enter the soil name code (and modifier when present) as found in the soil names file maintained at the local soil survey office. This soil code may be used to signify a codominant combination of two soils or an important, closely associated soil. The soil name code and modifier are consistent with those documented in the national CanSIS soil name and soil layer files (see attribute number 38). For areas where no soil name is established, use # for non applicable.

**NOTE:** Caution is recommended when using soil name 2 in area calculations particularly for subdominant landscapes.

**40 Parent material textural group as shown in the map symbol** (Cols. 80–81)

(*Ref.* Shields 1982)

Enter the code:

| *Code* | *Class* | *Description*[1] |
|---|---|---|
| sd | Sand | Group includes: CBS, CBLS, CS, S, LS, LFS, FS, GS, VGS, LVFS, VS, GLS, VGLS |
| sl | Sandy loam | Group includes: CBSL, SL, FL, GSL, VGSL, GFL |
| lm | Loam | Group includes: GL, CBL, L, GSIL, VL, SIL |

[1] See attribute number 10 for textural class descriptions.

| | | |
|---|---|---|
| cl | Clay loam | Group includes: CBCL, GSCL, GCL, SCL, VCL, CL, SICL |
| cy | Clay | Group includes: SC, GSIC, SIC, C, HC. |

**41 Area of polygon (kilohectares)** (Cols. 82–88)

Enter the number of kilohectares to one decimal place.

## Summary of soil landscape attribute codes and their classes occurring in the dominant and subdominant files

**01 Provincial code and map sheet number**

| *Provincial code* | *Map name* | *Sheet number* |
|---|---|---|
| BC | British Columbia—South | 1 |
| | —North | 2 |
| AL | Alberta | 1 |
| SK | Saskatchewan | 1 |
| MN | Manitoba | 1 |
| ON | Ontario—South | 1 |
| | —North | 2 |
| QU | Quebec—Southwest | 1 |
| | —Southeast | 2 |
| | —Central | 3 |
| | —North | 4 |
| NB | New Brunswick[1] | 1 |
| NS | Nova Scotia[1] | 1 |
| PE | Prince Edward Island[1] | 1 |
| NF | Newfoundland—South | 1 |
| | —North | 2 |
| YU | Yukon | 1 |
| NW | Northwest Territories | 1 to 9. |

**02 Polygon number**

**03 Kind of rock outcrop or other material at the surface**

| | | | |
|---|---|---|---|
| IC | Ice and snow | R4 | Hard rock, undifferentiated |
| OR | Organic soil | SO | Mineral soil |
| R1 | Soft rock, undifferentiated | WA | Water |
| R2 | Hard rock, acidic | UR | Urban |
| R3 | Hard rock, carbonaceous | | |

[1] For map, see *Soil landscapes of Canada, Maritime Provinces*; for extended legend see *Soil landscapes of Canada: Maritimes*.

**04 Percentage distribution of dominant and subdominant soil landscapes**

**05 Grid code for locating polygons**

**06 Regional landform**

| | | | |
|---|---|---|---|
| B | Tableland (or plateau) dominated | O | Organic wetland dominated |
| H | Hilland dominated | P | Plain dominated |
| M | Mountain dominated | S | Scarp dominated |
| | | V | Valley dominated |

**07 Local surface form**

*Mineral surface forms*

| | | | |
|---|---|---|---|
| D | Dissected | M | Rolling |
| H | Hummocky (or irregular) | R | Ridged |
| I | Inclined | S | Steep |
| K | Knoll and kettle | T | Terraced |
| L | Level | U | Undulating |

*Wetland surface forms*

| | | | |
|---|---|---|---|
| B04 | Domed bog | F01 | Northern ribbed fen |
| B05 | Polygonal peat plateau bog | F07 | Shore fen |
| B07 | Peat plateau bog | F11 | Slope fen |
| B09 | Atlantic plateau bog | F13 | Horizontal fen |
| B13 | Basin bog | S01 | Stream swamp |
| B14 | Flat bog | S04 | Basin swamp |
| B15 | String bog | M06 | Stream marsh |
| B16 | Blanket bog | M11 | Shallow basin marsh |
| B18 | Slope bog | M14 | Shore marsh |
| B19 | Veneer bog | | |

**08 Slope gradient class**

| | | | |
|---|---|---|---|
| A | 1–3% | D | 16–30% |
| B | 4–9% | E | 31–60% |
| C | 10–15% | F | >60% |

**09 Soil parent material mode of deposition** (or origin)

*Mineral materials and undifferentiated or unspecified organic materials*

| | | | |
|---|---|---|---|
| A | Alluvial | N | Fen (organic, unspecified) |
| B | Bog (organic, unspecified) | O | Organic, undifferentiated |

| | | | |
|---|---|---|---|
| C | Colluvial | R | Rock |
| D | Residual | S | Swamp (organic, unspecified) |
| E | Eolian | T | Anthropogenic |
| F | Fluvioglacial | U | Undifferentiated (mineral) |
| H | Marsh | V | Volcanic |
| L | Lacustrine | W | Marine |
| M | Morainal | | |

*Specified organic materials*

| | | | |
|---|---|---|---|
| 11 | Fibric sphagnum | 23 | Mesic woody forest |
| 21 | Mesic sedge | 25 | Mesic sphagnum |
| 22 | Mesic woody sedge | 31 | Humic sedge |

**10 Parent material texture**

| | | | |
|---|---|---|---|
| CBS | Cobbly sand | CBL | Cobbly loam |
| VGS | Very gravelly sand | GL | Gravelly loam |
| GS | Gravelly sand | L | Loam |
| S | Sand | VL | Very fine sandy loam |
| CS | Coarse sand | GSIL | Gravelly silt loam |
| FS | Fine sand | SIL | Silt loam |
| VS | Very fine sand | GSCL | Gravelly sandy clay loam |
| LFS | Loamy fine sand | SCL | Sandy clay loam |
| LVFS | Loamy very fine sand | VCL | Very fine sandy clay loam |
| CBLS | Cobbly loamy sand | CBCL | Cobbly clay loam |
| VGLS | Very gravelly loamy sand | GCL | Gravelly clay loam |
| GLS | Gravelly loamy sand | CL | Clay loam |
| LS | Loamy sand | SICL | Silty clay loam |
| CBSL | Cobbly sandy loam | SC | Sandy clay |
| VGSL | Very gravelly sandy loam | C | Clay |
| GSL | Gravelly sandy loam | GSIC | Gravelly silty clay |
| SL | Sandy loam | SIC | Silty clay |
| GFL | Gravelly fine sandy loam | HC | Heavy clay |
| FL | Fine sandy loam | | |

**11 Soil development**

| | | | |
|---|---|---|---|
| A | Brown Chernozemic | O | Organic Cryosolic |
| B | Dark Brown Chernozemic | P | Dystric Brunisolic |
| C | Black Chernozemic | Q | Humic Podzolic |
| D | Dark Gray Chernozemic or Dark Gray Luvisolic | R | Regosolic |
| | | S | Static Cryosolic |
| E | Gray Brown Luvisolic | T | Turbic Cryosolic |
| F | Gray Luvisolic | U | Gleysolic |
| G | Brown Solonetzic | V | Ferro-Humic Podzolic |
| H | Dark Brown Solonetzic | W | Humo-Ferric Podzolic |
| I | Brunisolic Gray Luvisolic | X | Fibrisol |
| J | Black Solonetzic | Y | Mesisol |

| | | | |
|---|---|---|---|
| K | Gray Solonetzic | Z | Humisol |
| L | Melanic Brunisolic | 2 | Folisol |
| M | Eutric Brunisolic | 3 | Podzolic Gray Luvisolic |
| N | Sombric Brunisolic | | |

**12 Surface texture of mineral soil to 15 cm**

(See Parent material texture in attribute number 10)

**13 Coarse fragment content in control section of mineral soils**

| | | | |
|---|---|---|---|
| A | <10% by volume | C | 31–65% |
| B | 10–30% | D | >65% |

**14 Rooting depth, unrestricted**

| | | | |
|---|---|---|---|
| 0 | <20 cm | 100 | 76–150 cm |
| 50 | 20–75 cm | 200 | >150 cm |

**15 Kind of compacted, consolidated, or contrasting layer**

| | | | |
|---|---|---|---|
| A | Compacted parent material | P | Placic horizon |
| B | Basal till | R | Rock |
| C | Compacted material (anthropogenic) | G | Gravel |
| | | L | Colluvium |
| D | Duric horizon | S | Sand |
| F | Fragipan | X | Silt |
| O | Ortstein | Y | Clay |

**16 Depth to compacted, consolidated, or contrasting layer**

| | | | |
|---|---|---|---|
| 1 | 0–49 cm | 4 | <100 cm for mineral overlays |
| 2 | 50–100 cm | | |
| 3 | >100 cm | 5 | <160 cm for shallow (terric) organic overlays |

**17 Drainage class**

| | | | |
|---|---|---|---|
| E | Excessive | I | Imperfect |
| R | Rapid | P | Poor |
| W | Well | V | Very poor |
| M | Moderately well | | |

**18 Available water capacity in upper 120 cm**

| | |
|---|---|
| 1 | 50 mm |
| 2 | 100 mm |

| | |
|---|---|
| 3 | 150 mm |
| 4 | 200 mm |
| 5 | 250 mm |
| 6 | Non applicable because of Solonetzic or saline soils |
| 7 | Non applicable because of high water table |
| 8 | Non applicable because of perennially frozen subsoils |

**19 Depth to water table, average**

| | | | |
|---|---|---|---|
| 1 | 0–2 m | 4 | 0–1 m |
| 2 | 2–3 m | 5 | 1–2 m |
| 3 | >3 m | 6 | 0–1 m, frozen subsoil |

**20 Ice type**

| | | | |
|---|---|---|---|
| 1 | Ice crystals and ice lenses | 3 | Massive ground ice |
| 2 | Ice wedges | 4 | Undifferentiated |

**21 Ice content**

| | |
|---|---|
| L | Low |
| M | Medium |
| H | High |

**22 Permafrost occurrence**

| | | | |
|---|---|---|---|
| V | Very sporadic | D | Discontinuous |
| S | Sporadic | C | Continuous |

**23 Active layer depth in soils with permafrost** (cm)

**24 Kind of patterned ground in soils with permafrost**

| | | | |
|---|---|---|---|
| 01 | Sorted circle | 08 | Nonsorted large polygon |
| 02 | Sorted net | 09 | Nonsorted small polygon |
| 03 | Sorted stripe | 10 | Earth hummock |
| 04 | Sorted large polygon | 11 | Lowland (peat) polygon |
| 05 | Sorted small polygon | 12 | Polygonal peat plateau |
| 06 | Nonsorted circle | 13 | No pattern |
| 07 | Nonsorted net | | |

**25 pH of upper 15 cm of soil measured in $CaCl_2$** (to one decimal)

**26 pH of upper 15 cm of soil measured in water** (to one decimal)

**27 Organic carbon of upper 15 cm of soil** (nearest % value)

**28 Nitrogen content of upper 15 cm of soil**

| | | | |
|---|---|---|---|
| 0 | <0.1% | 2 | 0.6–1.5% |
| 1 | 0.1–0.5% | 3 | >1.5% |

**29 Thickness of humus layer** (L,F,H)

| | | | |
|---|---|---|---|
| 0 | <5 cm | 3 | 21–40 cm |
| 1 | 5–10 cm | 4 | >40 cm |
| 2 | 11–20 cm | | |

**30 Calcareous class of parent material**

| | | | |
|---|---|---|---|
| 0 | Non calcareous | 2 | Strongly |
| 1 | Weakly | 3 | Extremely |

**31 Inclusions 1**

| | |
|---|---|
| A | Acid surface soil |
| BG | Bog |
| BL | Black Chernozemic soil |
| BC | Brown Chernozemic soil |
| BR | Bedrock, hard |
| BS | Bedrock, soft |
| C | Clay substrate |
| CA | Calcareous surface soil |
| CC | Colluvium |
| CH | Chernozemic soil |
| CY | Clay |
| D | Dissected surface form |
| DB | Dark Brown Chernozemic soil |
| DC | Deep colluvium |
| DG | Deep gravelly alluvium material |
| DU | Duric material |
| E | Eroded knolls |
| EO | Eolian material |
| ES | Eroded slopes |
| F | Fluvioglacial substrate |
| FH | Ferro-Humic Podzolic soil |
| FO | Folisol |
| G | Sandy loam morainal material |
| GF | Gravelly alluvium |
| GG | Gravelly fluvioglacial material |
| GL | Gleyed soil |
| GM | Gravelly marine material |
| GV | Orthic Gray Luvisolic soil |

| | |
|---|---|
| GY | Gleysolic soil |
| HC | Shallow lithic colluvium |
| HP | Humo-Ferric Podzolic soil |
| HU | Hummocky surface form |
| I | Brunisolic Gray Luvisolic soil |
| IC | Ice |
| ID | Imperfectly drained soil |
| L | Melanic Brunisolic soil |
| LC | Lacustrine material |
| LF | Loamy alluvium material |
| LI | Lithic layer |
| LM | Loamy morainal till |
| LO | Loamy marine material |
| LS | Silty lacustrine material |
| LU | Luvisolic soil |
| M | Eutric Brunisolic soil |
| ML | Clay loam marine material |
| MP | Moss peat |
| N | Sombric Brunisolic soil |
| NN | None |
| O | Organic material |
| OC | Organic Cryosolic soil |
| OT | Ortstein |
| P | Dystric Brunisolic soil |
| PD | Poorly drained soil |
| PP | Poorly drained, peaty soil |
| R1 | Soft rock outcrops |
| R2 | Hard rock outcrops, acidic |
| R3 | Hard rock outcrops, basic |
| R4 | Hard rock outcrops, undifferentiated |
| RD | Rapidly drained soil |
| RG | Regosolic soil |
| SA | Saline soil |
| SC | Static Cryosolic soil |
| SD | Sandy marine material |
| SF | Sandy alluvium |
| SG | Sandy fluvioglacial material |
| SH | Gravelly shoreline |
| SL | Silty alluvium |
| SO | Sombric Humo-Ferric Podzolic soil |
| SP | Steep surface form |
| SS | Silty surface texture |
| ST | Stoney surface |
| SY | Sandy material |
| T | Till substrate |
| TA | Talus |
| TC | Turbic Cryosolic soil |
| TE | Terric layer |
| TR | Terraced surface form |

| | |
|---|---|
| TT | Anthropogenic material |
| VA | Volcanic ash |
| VS | Very shallow lithic layer |
| WD | Well-drained soil |
| WE | Wind erosion |
| WT | Wetlands |
| X | Fibrisol |
| Y | Mesisol |
| Z | Humisol |
| 11 | Fibric-sphagnum soil |
| 14 | Patterned ground |
| 17 | Bouldery material |
| 21 | Mesic-sedge material |
| 23 | Mesic-woody forest material |

**32 Inclusions 2** (see attribute number 31 for codes)

**33 Vegetative cover or landuse, or both**

| | |
|---|---|
| A | Agricultural crops |
| B | Bog |
| C | Coniferous forest |
| D | Deciduous forest |
| F | Fen |
| G | Grassland |
| H | Arctic desert |
| M | Mixed deciduous and coniferous forest |
| P | Parkland |
| R | Marshland |
| S | Shrubland |
| SP | Sedge peat |
| TA | Tundra, alpine |
| TL | Tundra, low shrub |
| TM | Tundra, medium shrub |
| U | Unvegetated surface |

**34 Lake size estimated from LANDSAT imagery**

| | |
|---|---|
| S | Small |
| M | Medium |
| L | Large |
| V | Very large |

**35 Water bodies estimated from LANDSAT imagery, which are wholly contained within the polygon**

| | |
|---|---|
| F | Few |
| C | Common |
| M | Many |
| A | Abundant |

**36 Reliability class of polygon**

| | |
|---|---|
| V | Very low |
| L | Low |
| M | Medium |
| H | High |

**37 Complexity class of polygon**

| | |
|---|---|
| L | Low |
| M | Medium |
| H | High |

**38 Soil name 1**

**39 Soil name 2**

**40 Parent material textural group** (as shown in the map symbol)

| | | | |
|---|---|---|---|
| sd | Sand | cl | Clay loam |
| sl | Sandy loam | cy | Clay |
| lm | Loam | | |

**41 Area of polygon** (kilohectares)

## Maps in digital form

This section defines the minimum and complete content of digital soil map data for maps in the *Soil landscapes of Canada* series. For a general description of CanSIS and the data organization and manipulation capabilities please refer to *CanSIS manual I: General description* (MacDonald and Valentine in preparation).

CanSIS is a soil geographical information system (GIS) developed and supported by LRRC. Amongst other activities, CanSIS personnel develop and manage the national soil data base (NSDB), which contains the location, nature, and attributes related to the biological productivity of major soils of Canada. All completed soil landscape maps are stored in digital form in the NSDB of CanSIS.

The basic products of CanSIS are maps and reports in computer-generated format (either digital or hard copy). Where possible, routine procedures are used to streamline the operations. However, custom products are created as required and within the constraints of resources. This section relates only to the release and distribution of data in digital form.

All digital soil maps that meet the minimum required level of data AND that have been published are available for release in digital form. There is a charge for materials used and there may be a charge for the service.

**NOTE**: DIGITAL DATA THAT DO NOT YET MEET THE MINIMUM LEVEL OF COMPLETENESS AND/OR THAT HAVE NOT BEEN PUBLISHED CAN BE RELEASED ONLY WITH PERMISSION OF THE AUTHOR.

A signed DATA RELEASE AGREEMENT (included with the data) must be returned and maintained on file for all digital data released to other individuals or agencies. Other than the terms outlined in this agreement, there are no additional conditions on the use of the data by an outside agency.

Normally, the author of the map will be advised of the release of the data in digital form.

Data are released on magnetic tape or floppy disk in a limited number of standard formats easily produced from the ARC/INFO format. The exact number and type changes with user requirements.

*Soil landscapes of Canada* data have been compiled at a map scale of 1:1 million; they are released in units of metres in Lambert Conformal Projection. The accuracy of all data released is documented in the project pedigree file as calculated by comparison of points on the coverage with standard reference points. Where the data cannot be projected to georeferenced coordinates with an accuracy equivalent to 0.5 mm on the manuscript (the definition of cartographic quality at LRRC), the data will remain in arbitrary table coordinates.

**Definition of a complete digital soil map** A complete digital soil map includes all six items in the following list. Within the list, the items shown as **mandatory** represent the absolute minimum level of data release of map data in digital form:

- A complete project pedigree file (**mandatory**).
- Standard coverage for the soil theme (**mandatory**)
  (may include hydrographic theme for base data and annotation theme).
- For *Soil landscapes of Canada* maps (scale of 1:1 million) the coverage includes three (3) attribute files relating to the polygon. These are the polygon attribute table (PAT) as created by the ARC/INFO software, a DOMinant attribute file defining the properties of the dominant landscape component of each polygon and a SUBdominant attribute file describing the subdominant components as already described. Each of these files contain references to specific typical soils, which are further characterized in the soil names and soil layer files. The user is responsible for making any linkages required between the files.
- A subset of the soil names file (SNF) and soil layer file (SLF), which contains all combinations of SOIL-CODE + MODIFIER, is included as part of the complete digital soil map.
- All ARC/INFO coverages are in geographic units or documented to be not accurate on conversion (**mandatory**). All ARC/INFO coverages include arc attribute tables (ATT) files to allow feature codes to be identified.

- Files to indicate the tolerances used and files to specify the parameters of the projection and coordinates used (**mandatory**).

**Elements of a complete digital soil map** The following files make up the information associated with digital soil maps:

*Project pedigree file* The project pedigree file provides a record of its lineage or pedigree of the digital map and the data sources and checkpoints along the way to its completion. This file is produced for each map in the system.

*Thematic boundary files and associated information* The ARC/INFO software generates a range of files to define the soil polygons (an ARC/INFO coverage). We have adapted some files to our application. The ARC attribute files characterize the thematic boundaries. The ARC attributes define features such as hydrographic or administrative boundaries normally stored and managed by other agencies. The definitions used by LRRC are identical to those of other agencies, in this case Energy, Mines and Resources (EMR), and are identified by a subset of codes appropriate for our application.

In addition, the digital product is a model of a portion of the earth's surface. Consequently, information about the georeferencing system, projection, and so on becomes important. Furthermore, it is important to record the parameters of tolerance and accuracy used in the computer to produce the final digital record.

*Attribute files and their relationships* The other important part of the definition describes the attributes and the relationships between the various kinds of data that make up a complete digital soil map. In terms of line data, the relationships incorporate base map data and other coverages to add positional reference information to the soil thematic boundaries. Within the thematic coverage, the individual polygons define the soil and landscape areas that are to be represented on a soil map. The polygon attribute table (PAT), as created by the geographic information system (GIS), can be related to attribute files to define the properties of each polygon and to relate them to the repetitive components of the soil map (Fig. 12).

The LRRC has verified that attribute records are present for each polygon. Areas that have not been characterized by soil landscape attributes are identified as water, ice, or as urban classes of the attribute (03) "kind of rock outcrop or other material at the surface" recorded in the dominant landscape file where they have a percentage distribution of 100 (see attribute 04). Further, the LRRC has validated the data. For all polygons for which the dominant landscape occupies less than 80%, and which also have inclusions occupying up to 15%, a record is confirmed in the subdominant landscape file.

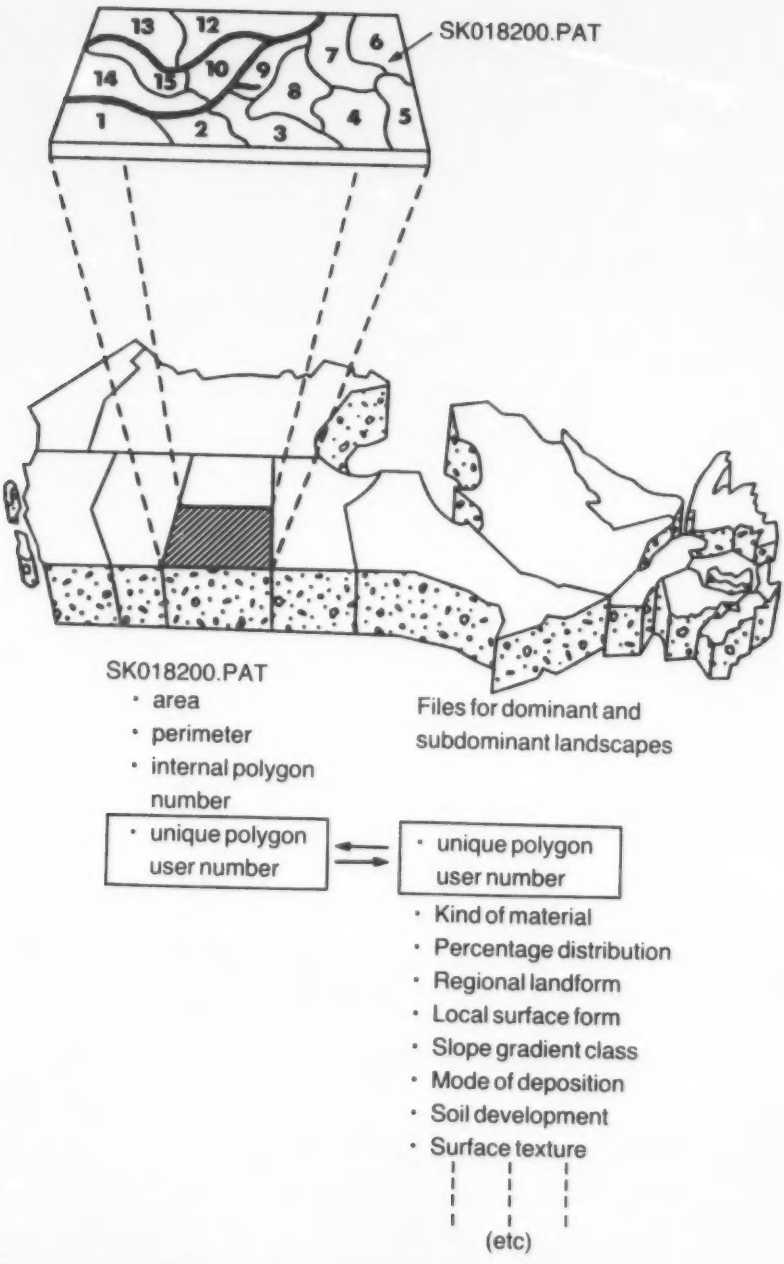


**Fig. 12 Attribute files for soil landscape maps.**

*Soil names and soil layer files* The soils associated with each soil landscape represent entities that can occur over a wide geographic region. They are characterized by general properties of the soil (e.g., drainage, water table, and mode of deposition) and also by properties of the layers or horizons. The soils identified in the landscape file represent typical soils in the landscape but do not necessarily represent the entire landscape component. The soil code and modifier from the landscape file points to the soil names and soil layer files for specific detailed information about the soil. These latter files are provincial in scope. The overall organization of the attribute data is within a relational data base model.

## Products available

We are able to produce soil landscape information in various formats. The following products can be obtained on request from:

Land Resource Research Centre
Research Branch, Agriculture Canada
K.W. Neatby Building, Rm. B-71
Ottawa, Ont. K1A 0C6
Tel. (613) 995-5011
Fax (613) 995-7283

- printed, full-color map (*Soil landscapes of Canada*) and the short report containing the extended legend, packaged in a kit folder together with a sheet of illustrations and an information flyer
- full-color map only
- maps, legends, and lists of attributes for maps in preparation, available in manuscript form
- selected interpretive maps based on the attributes provided in the extended legend; interpretive maps completed or in preparation (others will follow) are

  **Water erosion risk** (for all provinces)

  **Wind erosion risk** (for Alberta, Saskatchewan, Manitoba, and southern Ontario)

  **Soil salinity** (for Alberta, Saskatchewan, and Manitoba)

  **Acidification** (for British Columbia, southern Ontario, and provinces east of Ontario)
- detailed computerized legends available on diskettes in ASCII format
- map data in digital form.

## Procedures for release of digital soil map data

Consult the current list of *Soil landscapes of Canada* JOBIDs and map titles:

| *JOBID* | *Map title* |
|---|---|
| BC01830N | Soil landscapes of Canada, British Columbia—North |
| BC01830S | Soil landscapes of Canada, British Columbia—South |
| AL088200 | Soil landscapes of Canada, Alberta |
| SK018200 | Soil landscapes of Canada, Saskatchewan |
| MN068200 | Soil landscapes of Canada, Manitoba |
| ON017901 | Soil landscapes of Canada, Ontario—South |
| ON017902 | Soil landscapes of Canada, Ontario—North |
| QE018501 | Soil landscapes of Canada, Quebec—Southwest |
| QE018502 | Soil landscapes of Canada, Quebec—Southeast |
| QE018503 | Soil landscapes of Canada, Quebec—Central |
| QE018504 | Soil landscapes of Canada, Quebec—North |
| NB018300 | Soil landscapes of Canada, New Brunswick |
| PE018500 | Soil landscapes of Canada, Prince Edward Island |
| NS018501 | Soil landscapes of Canada, Nova Scotia |
| NF018500 | Soil landscapes of Canada, Newfoundland—South |
| NF018501 | Soil landscapes of Canada, Newfoundland—North |
| YT018500 | Soil landscapes of Canada, Yukon |

Any person, agency, or organization interested in obtaining digital map data for the soil landscape maps should contact the following:

CanSIS Project Leader
Land Resource Research Centre
Research Branch, Agriculture Canada
Central Experimental Farm
K.W. Neatby Building
Ottawa, Ont. K1A 0C6

and provide the following information, preferable in writing:

- Provide contact name at user end
- Give contact address
- List Tel.
- List Fax
- Identify user's software and hardware (e.g., ARC/INFO running on a VAX system)
- Identify data request for:
  *Soil landscapes of Canada* coverages/data—JOBID, Map title
- Specify optimum export format for coverage data
- Specify requirement and export format for attribute data
- Choose transfer medium (disk, tape)
- Choose preferred method of delivery by courier, regular mail, or other
- State date required.

## References


Agriculture Canada Expert Committee on Soil Survey. 1987. The Canadian system of soil classification, 2nd ed. Agric. Can. Publ. 1646, 164 pp.

Brown, R.J.E. 1970. Permafrost in Canada: Its influence on northern development. University of Toronto Press, Toronto, Ont., 234 pp.

Brown, R.J.E. 1978. Permafrost map of Canada. Plate No. 32 *in* Hydrological atlas of Canada. Dept. of Fisheries and Environment, Ottawa, Ont.

De Jong, R.; Shields, J.A.; Sly, W.K. 1984. Estimated soil water reserves applicable to a wheat-fallow rotation for generalized soil areas mapped in southern Saskatchewan. Can. J. Soil Sci. 64:667–680.

Expert Committee on Soil Survey. 1982. The Canada soil information system (CanSIS) manual for describing soils in the field, revised. Land Resource Research Institute, Research Branch, Agriculture Canada, Ottawa, Ont., 166 pp.

Geoanalysis Ltd. 1981. Landform descriptive classes for higher levels of ecological land classification. S. Ringrose, ed. Contract No. KL229-0-4581, Lands Directorate, Environment Canada, 18 pp.

MacDonald, K.B.; Valentine, K.W.G. in preparation. CanSIS manual I: General description. Land Resource Research Centre, Research Branch, Agriculture Canada, Ottawa, Ont.

National Wetlands Working Group. 1987. The Canadian wetland classification system. Land Conservation Branch, Canadian Wildlife Service, Environment Canada. Ecological Land Classification Series No. 21, 18 pp.

Permafrost Subcommittee, Associate Committee on Geotechnical Research. 1988. Glossary of permafrost and related ground-ice terms. National Research Council of Canada, Ottawa, Ont. Technical Memorandum No. 142, 156 pp.

Research Branch, Agriculture Canada. 1976. Glossary of terms in soil science. Research Branch, Canada Department of Agriculture, Ottawa, Ont., Publication 1459, 44 pp.

Shields, J.A. 1982. Generalized soil landscape maps. Pages 62–80 *in* Proceedings, 4th annual meeting of the Expert Committee on Soil Survey, Victoria, B.C.

Tarnocai, C. 1977. Manual interpretation of LANDSAT data for land classification, Northern Keewatin, N.W.T. Canada Soil Survey, Winnipeg, 15 pp.

Tarnocai, C. 1984. Peat resources of Canada. National Research Council of Canada, Division of Energy, Peat Program, Halifax, Nova Scotia, 17 pp.

United States Department of Agriculture. 1986. Glossary of landform and geologic terms, amendment to national soils handbook. Soil Conservation Service, Washington, D.C., 45 pp.

Washburn, A.L. 1980. Geocryology. Halstead Press, a division of John Wiley and Sons, Inc., New York, 406 pp.